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American Fern Journal

Vol. 9 JANUARY–MARCH, 1919 No 1.

Notes on American Ferns—XIII[1]

WILLIAM R. MAXON

PTERETIS NODULOSA (MICHX.) NIEUWLAND.—The American ostrich fern, which is essentially boreal in distribution, is one of the rarer ferns in the vicinity of Washington, D. C., occurring on a few islands of the Potomac River and on alluvial bottoms of both the Maryland and Virginia sides. The Virginia locality, in Fairfax County, was recorded in 1899[2] as a new southernmost one for this species. The southern range may now be extended by the record of specimens recently collected in West Virginia, as follows: Abundant in a meadow along Dry Fork, a branch of Cheat River, at a point about 3 miles south of Horton, Randolph County, West Virginia, July 10, 1918, *E. T. Wherry & H. W. Trudell.* A specimen of this collection has been deposited in the National Herbarium by the collectors.

PELLAEA ANDROMEDAEFOLIA (KAULF.) FÉE.—This species, which is abundant at low altitudes through a large part of California, from Mendocino and Tehama counties southward to Lower California, occurs also in southwestern Oregon. The record is based on a characteristic specimen in the herbarium of the Oregon Agricultural College at Corvallis, collected at Roseburg, Oregon, in April, 1887, by Thomas Howell and labeled

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[1] Published with the permission of the Secretary of the Smithsonian Institution.

[2] Fern Bull. **7**: 71.

[Vol. 8, No. 4 of the JOURNAL, pages 97–130, Plates 5 and 6, was issued Jan. 20, 1919.]

in his hand as *P. andromedaefolia.* This extension of range, though not remarkable, seems never to have been placed on record. The reported occurrence of this species in Arizona appears to have been based upon misidentified specimens of *Pellaea intermedia* Mett.

SELAGINELLA SHELDONI MAXON.—The range of this recently described[1] ally of *S. rupestris,* of Texas and Oklahoma, is somewhat extended by the following Texas specimens, all in the herbarium of the Missouri Botanical Garden: Llano, October, 1847, *Lindheimer* 77; Llano County, on damp rocks, May, 1885, *Reverchon;* Hueco Tanks, July 1, 1895, *A. Isabel Mulford* 121; canyon north of Van Horn, El Paso County, July 11, 1900, *Eggert.*

WOODSIA SCOPULINA D. C. EATON.—A remarkable apparent extension of the range of this chiefly western species was brought to the writer's attention some time ago by Mr. C. A. Weatherby, who noted that a specimen in the Gray Herbarium said to have been collected September 14, 1903, "on a mountain 4 miles north of Old Sweet, West Virginia, altitude 850 meters," by Mr. and Mrs. E. S. Steele (No. 306), and distributed as *W. ilvensis,* seemed to be *W. scopulina.* The occurrence of *W. scopulina* in the West Virginia mountains was regarded as so unlikely as to suggest the possibility of mixed labels. The National Herbarium specimen could not at once be located; but Mr. Steele, while having no special recollection of the plant, referred to the interesting occurrence in the region mentioned of other types adventive from the west and saw no reason to doubt the authenticity of locality data in this instance. The specimen, since found, substantiates Mr. Weatherby's identification. Specimens of the same number were doubtless distributed to other herbaria

[1] Proc. Biol. Soc. Washington **31**: 171. 1918.

as well; and as there is no likelihood whatever that so large a series of individuals from some distant western region could have been introduced accidentally into the West Virginia collection, the latter locality data may properly be regarded as true. The station in question, which is on the boundary line of Virginia, extends the range of this species from Ontario and Quebec, a distribution not exactly paralleled by any other fern, so far as the writer knows. The distribution and distinctive characters of *W. scopulina* and related species form the subject of notes to be published shortly.

CHEILANTHES EATONI BAKER.—This species, though shown by Eaton[1] to be amply distinct from *C. tomentosa* Link, has rather commonly not been so recognized but regarded instead as a variety of *C. tomentosa*, and inasmuch as occasional specimens of each are still misidentified as pertaining to the other, it seems desirable to point out again some of the characteristic differences. *Cheilanthes tomentosa*, described originally from cultivated material, ranges from Virginia to Georgia, westward through Tennessee, Alabama, Arkansas, and Oklahoma to central Texas, the Organ Mountains of southern New Mexico, the Santa Catalina, Huachuca, and Santa Rita Mountains of southeastern Arizona, and sparingly into northern Mexico. It seems nowhere very abundant and becomes decidedly rare in the western portion of its range. *Cheilanthes Eatoni*, founded on Wright's No. 816 from western Texas, ranges from Oklahoma and central Texas widely through New Mexico to Colorado[2] and central Arizona, and southward far into Mexico, extending at least to the State of Puebla.

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[1] Ferns N. Amer. **1**: 351, 352.

[2] Specimen in the National Herbarium, collected at "Devils Hole, Canyon of the Arkansas, 21 miles west from Canyon City, Colorado," Nov., 1875, by T. S. Brandegee. This locality is the only one listed by Rydberg (Fl. Colo. 4. 1906).

It is apparently as abundant in Arizona and New Mexico as *C. tomentosa* is rare in these regions. In a very few instances (namely, plants collected in Texas by Jermy, in the Huachuca Mountains by Lemmon in 1882, and in Mexico by Edw. Palmer) specimens of both have been brought together and distributed as one or the other species, but there is no certainty that they grew in close proximity. At any rate the characters distinguishing the two species are constant and quite sufficient for their immediate recognition. These may be summarized as follows:

C. tomentosa

Stipe and rachises rather copiously clothed with lax tawny hairs and numerous subflexuous, twisted, nearly filiform, laxly spreading scales, these mostly persistent and at length forming a loose or matted tomentum; broad scales wholly wanting.

Segments copiously but rather loosely tomentose beneath, delicately villous-tomentulose above with long, twisted, flexuous hairs, the segments not bound together by an intricate hairy covering.

Herbaceous margin of the segments deeply recurved, abruptly modified to a rather broad, white, distinctly membranous proper indusium.

C. Eatoni

Stipe, primary rachis, and lower side of secondary rachises imbricate-paleaceous; relatively large, flat, oblong-lanceolate, ascending scales of stipe and primary rachis underlaid by numerous, appressed, minute, acicular, rigid ones; scales of secondary rachises ovate-acuminate, widely imbricate, flaccid.

Segments densely matted-tomentose beneath, copiously and rather coarsely tomentose above, the entangled hairs of both surfaces closely enveloping and joining the fragile segments.

Herbaceous recurved margin of the segments less abruptly and completely modified, the narrow, whitish, membranous border forming a very scant true indusium.

There are additional characters found in the greater size of *C. tomentosa*, its more spreading and dissected pinnae, and the shape, number, and relative position of the segments; but these variable features are so dependent upon age, vegetative vigor, and seasonal condition as to be scarcely of diagnostic importance. The Jamaican plant long passing as *C. tomentosa* is a new species, shortly to be described.

CHEILANTHES WOOTONI MAXON.—This species, lately described from Arizona and New Mexico material, extends also to western Texas, a specimen at hand having been collected at El Paso, by Marcus E. Jones, April 16, 1884, and distributed as *C. Lindheimeri* Hook. Because of their tomentulose upper surfaces, *Cheilanthes Eatoni*, *C. tomentosa*, and *C. Lindheimeri* have not often been confused with *C. myriophylla* or with the several species mistakenly referred to it. They were accordingly omitted from the recent paper[1] dealing with the United States forms associated with *C. myriophylla*.

DRYOPTERIS DRYOPTERIS (L.) CHRIST.—An extension of range is noted in New Mexico specimens recently received from the Biltmore Herbarium, collected in moist thickets near Chama, Rio Arriba County, August 20, 1896, and distributed as No. 3136a of the Biltmore series, the collector's name not stated. The western area of this species has been known to extend from Alaska to Oregon, south in the mountains to Arizona and Colorado, but the plant has not hitherto been reported from New Mexico.

WASHINGTON, D. C.

Fern-hunting in Panama

ELLSWORTH P. KILLIP

The following article relates to the more general features of the fern flora of the Isthmus of Panama. During eight months recently spent in this region I made extensive collections, and specimens of ferns and of grasses and other flowering plants have been referred respectively to Messrs. Maxon, Hitchcock and Standley, of the United States National Herbarium. A number

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[1] Proc. Biol. Soc. Washington **31**: 139–152. 1918.

of the ferns found are new species, and many belong to genera that need critical study and revision, such as Selaginella, Pteris, Tectaria, Polystichum, and Adiantum. It is impossible, therefore, to publish at this time a list of the three or four hundred different species collected. A brief account of the various regions visited may, nevertheless, be of interest.

With the city of Ancon, at the Pacific terminal of the Canal, as a center during seven months of my stay on the Isthmus, the territory explored falls naturally under five general headings: Juan Diaz, the Chagres River, Frijoles, the Pacific end of the Zone, and the Island of Taboga. The first three regions are characterized by a dense wet jungle, where, mostly along the banks of streams, an extensive and varied fern flora is to be found; the last two by dry hillsides and open woods, where ferns are scarce. One month was spent among the high mountains of western Panama, where a totally different and extremely luxuriant flora exists.

JUAN DIAZ

The small native village of Juan Diaz is situated upon a river of the same name, some ten miles east of the city of Panama. About a mile beyond this village the dense tropical jungle begins, and some fourteen miles further lies the Pacora River, the limit of the region explored. The jungle is broken at frequent intervals by open prairies, or sabanas. A road runs from Panama to Pacora, but only in the months of February and March—the dry season—is it passable its entire length. During the remainder of the year one cannot safely go in an automobile farther than the Tapia River, about four miles beyond Juan Diaz. It is in this region between the Juan Diaz and Tapia Rivers, extending north about five miles and south

to the Pacific Ocean, that most of my botanizing was done. Fortunately I had my automobile with me, and so was able to make about twenty-five trips between the middle of September and the middle of May.

A tropical jungle is well-nigh impenetrable, and the only way to go through it is by following occasional hunting-trails or by wading up and down the countless small streams. One of the best of these trails ran first through a dense palm jungle where various species of Adiantum and Lindsaya, *Dictyoxiphium panamense*, and *Dryopteris refulgens* predominated, then crossed a couple of sabanas and ran along the edge of "Tree-fern Gully." This was a deep ravine with a narrow stream at the bottom, very rich in ferns. Several specimens of a striking species of Cyathea occurred there, as well as unusual species of Dryopteris, Tectaria, and Leptochilus. Great plants of *Maxonia apiifolia*, with huge sterile fronds and strikingly different, skeleton-like fertile ones, were found in abundance, climbing tree trunks. The wet clay banks of the stream were covered with many small ferns, while upon fallen logs various species of Polypodium, Vittaria, and Hymenophyllum were growing. Farther down this stream the handsome *Diplazium grandifolium* became the predominant fern, while at its junction with one of the main branches of the Juan Diaz River, the high rocky banks were covered with species of Dicranopteris and Pteris.

Another interesting trail passed through a forest, where, in addition to the many ever-present species of Adiantum, the most striking fern was *Lophidium elegans*, a fern with sterile fronds greatly resembling a young palm. Among the rocks in the dry sabanas which are met with frequently on this trail, four different species of Anemia were found. (*A. oblongifolia*, *A. pastinacaria*, *A. hirsuta*, and *A. humilis*.) Along

the banks of streams in this vicinity the very rare *Dryopteris cumingiana* was collected in great abundance.

The streams of the Juan Diaz-Pacora region fall into two classes as regards the fern flora to be found along their banks. The larger rivers, as the Juan Diaz, Tapia, Tacumen, Tataria, and Pacora, with a width exceeding fifteen feet and a depth of two to five feet (at a time of average rainfall), are characterized by coarse species of Tectaria and Pteris, and by *Dryopteris mollis, D. Mercurii, Blechnum occidentale, Asplenium obtusifolium*, and the densely tufted *Asplenium formosum*. Probably the most abundant of the terrestrial ferns found in this habitat are *Cyclopeltis semicordata* and the many species of Adiantum. On the limbs of trees overhanging these streams are seen the giant *Polypodium phyllitidis* and *Asplenium serratum*, both in outline resembling somewhat our *Scolopendrium vulgare*.

The steep banks of the smaller streams present quite a different fern flora. Two species of Leptochilus occur in great quantities, running on the clay soil and climbing over rocks and up trees. The narrow gorges are choked with specimens of the coarse ferns *Danaea nodosa, Saccoloma elegans, Alsophila blechnoides*, and *Diplazium grandifolium*. Climbing over shrubs and trees is *Lygodium radiatum*, a species nearly confined to the Isthmus.

The first trip was made to this region September 30, 1917, and the last May 12, 1918, so that opportunity was afforded for studying the flora during the succession of seasons. The amount of rainfall increased rapidly from September to November, reaching its maximum about the end of November. In December it fell off considerably; in January there were only two or three showers; in February and the first twenty days of March there was practically no rain at all; while in

April and May three or four hard showers occurred each week. The ferns were naturally affected to a certain extent. Between September and December the epiphytic species of Polypodium, Elaphoglossum, Dryopteris, Asplenium, and Trichomanes were at their best, December being the month of their maximum fertility. During the dry season these shriveled up completely, and by the middle of March scarcely one could be seen. Of terrestrial ferns the more delicate species of Adiantum and Anemia followed a similar course. Hardier Adiantums and the bulk of the other ferns seemed to be in good condition throughout the eight months, new fronds continually unfolding to take the place of the dying ones. A number of species seemed to attain a certain development toward the close of the rainy season, remain "passive" during the dry season, and rebegin their growth with the first rains of April.

THE CHAGRES RIVER

The Chagres is the most important river in Panama, rising in the eastern part of the Republic (the Darien country), running west through the center of the Isthmus, bending to the north in the Canal Zone and entering the Atlantic to the west of the Canal entrance. The building of the dam at Gatun caused this river to overflow, forming Gatun Lake, the flooded area reaching Gatuncillo some ten miles up the original valley above the channel of the Canal. Above this point the river resumes its natural size, and its course lies through dense tropical jungles from the upper regions which man has seldom visited.

Through the kindness of officials of the Panama Canal, a party of us (all botanists, two being members of the American Fern Society) had placed at our disposal the Hydrographic Station at Ahlajuela, some ten miles above Gatuncillo. In the two days spent here

no adequate study of the ferns could be made, but a five-mile walk through the jungle along the south side of the river from Ahlajuela to El Vigia furnished a general idea of the country. Most of the ferns found here had been seen in greater or lesser abundance in the Juan Diaz country. The trees up the Chagres were much larger in every way than those in the Juan Diaz forests, and consequently there was an increase of epiphytic ferns. Quantities of *Dryopteris patula*, *Elaphoglossum spathulatum*, *Polypodium phyllitidis*, *P. occultum*, *P. polypodioides*, Vittaria, and Ananthacorus exemplified this.

FRIJOLES, CANAL ZONE

The many short trips which I made in the Pacific section of the Canal Zone between Culebra and Balboa proved so uninteresting from a fern standpoint that I was rather inclined to belittle the whole Zone and concentrate in the Juan Diaz country. In the latter part of January, however, I experimented in the neighborhood of Frijoles along the eastern shore of Gatun Lake. And such a wealth of ferns! Many of the Juan Diaz species were there, while a very great number not found elsewhere on the Isthmus were gathered.

Here let me insert a word of advice to the fern collector who may be "passing through" the Zone with but a day or so for botanizing. Take the train to Frijoles, walk north along the tracks for a couple of miles and explore the ten or twelve little gullies which you will pass on the way. It is a very accessible region and thorough investigation will undoubtedly result in the discovery of many species new to science.

As previously mentioned, the damming of the Chagres River at Gatun caused the waters to flood a vast area and to creep up the countless valleys of streams tributary to the Chagres. The presence of this great body of

water, kept at approximately the same level throughout the year, makes this region independent of the fluctuation of rainfall and results in a most luxuriant vegetation. The railroad swings around the eastern shore of the lake, crossing the many bays on long causeways. As one walks along the track, one comes at frequent intervals upon deep pools of water with gullies extending back from them into the hills. Floating in these pools are logs covered with the coarse fronds of *Acrostichum aureum* and *Dryopteris serrata*, with *Nephrolepis pectinata* and various grasses and sedges intermingled with them. The water in the pools is from fifteen to twenty feet deep, so one must hack one's way by machete through the dense undergrowth around the pool to the valley in the rear. Here ferns of all sizes and shapes are to be found in great profusion. Giant specimens of Hemitelia, Cyathea, and Dennstaedtia, slightly smaller examples of Tectaria, Alsophila, Diplazium, Dryopteris, Leptochilus, and Asplenium, tiny Polypodiums and "filmies," all are there. In addition to this luxuriant tropical vegetation, a series of rapids and waterfalls serves to make this a most picturesque and interesting region. At present it is at its best; the waters of the lake have been at their present level sufficiently long to produce a wonderful vegetation, while the hand of man, which has been clearing away the jungle on both sides of this region to make room for pastures, in order that the Canal Zone may be self-sustaining, has not yet touched this spot. The western side of Gatun Lake is undoubtedly of a similar character and will probably remain in its native wild state long after the eastern shore has felt the effect of American energy.

THE PACIFIC END OF THE CANAL ZONE

The small amount of rainfall at the Pacific end of the Zone, as compared with other parts of the Isthmus,

together with the rapid disappearance of the forest, serves to make the fern flora of this region exceedingly sparse. The open woods from Empire and Summit (at the top of the Divide) to the Pacific present a certain sameness in fern flora. Some eight or ten species of Adiantum, *Pteridium caudatum*, *Blechnum occidentale*, *Pityrogramma calomelaena*, *Polypodium costaricense*, *P. polypodioides*, *Dryopteris tristis*, *Asplenium auritum*, *Lygodium polymorphum*, and *Dicranopteris flexuosa* make up the great bulk of the ferns.

Ancon Hill, with an altitude of about 650 feet, is situated on the shore of the Pacific near the Canal entrance. The lower half of the hill is occupied by the towns of Ancon and Balboa; the upper half consists partly in dry fields and partly in woods. In addition to many of the species mentioned above, three rather noteworthy ferns were found on the hill: *Adiantum filiforme*, *Anemia oblongifolia*, and a species of Lindsaya.

TABOGA

The island of Taboga, situated in the Pacific some twenty miles off the mainland, lying similarly in the "dry" belt and consisting largely in grass-covered hills and more or less open woods, is not of great interest to the fern collector. In addition to the ferns usually characteristic of this habitat there occur on the island quantities of *Nephrolepis biserrata* and *N. exaltata*, found chiefly on palm trees, *Dryopteris longifolia*, and a rather large Polypodium, possibly new.

EL BOQUETE, PROVINCE OF CHIRIQUI

One of the most interesting regions for ferns on the whole North American Continent lies among the mountains of the Cordillera, between the Provinces of Chiriqui and Bocas del Toro, in the western part of the Republic of Panama near the Costa Rican boundary. The

village of El Boquete is situated at an altitude of about 4000 feet at the foot of Chiriqui Volcano and about forty miles from the Pacific Ocean. The Chiriqui railroad, extending from the seaport, Pedregal, to Boquete, ascends gradually through dry prairies to the forest-covered mountains, following first the Rio Chiriqui and then one of its most important branches, the Rio Caldera.

With the Hotel Lino, two miles above the village of Boquete, as headquarters, I spent the greater part of the month of February botanizing among the mountains. Four or five trips of one day each were made along Holcomb's trail up the Rio Caldera for a distance of ten to twelve miles; four trips up the valley of the Rio Piarnasta and over the newly-cut Roballo trail to the east of Boquete; one along the Horquete Range; one of three days along Holcomb's trail to the summit of the Divide and down the Atlantic side; and one of three days to the top of Chiriqui Volcano, 11,000 feet high.

The valleys of the Caldera and Piarnasta lie in a very wet belt. Almost every afternoon a fine mist blows over the Divide and keeps this region in continual moisture and epiphytic ferns naturally are in very great abundance. Although the volcano lies in the dry belt, south of the main cordillera, a number of very interesting ferns were found on the way up and on the barren rocks at the summit.

From the fern standpoint the most interesting trip was that over Holcomb's Trail to the Divide. This trail was originally planned to extend from Boquete to the United Fruit Company's property at Bocas del Toro, but after reaching the top of the Divide and extending a short distance down the Atlantic side, was left uncompleted. The trail is not kept open and the two camps—one situated some twelve miles from Bo-

Cyathea divergens Kunze.
Horquete Mts., Province of Chiriqui, Panama

quete at the foot of the Divide, and the other several miles over the Divide on the Atlantic side—are in a state of complete ruin. A new camp has, however, recently been built a couple of miles south of the earlier Camp I, and this we made our headquarters. To avoid confusion, I have called this new camp Camp A, designating the site of the earlier one as Camp I.*

As I had "combed over" quite thoroughly the region in the vicinity of Camp A on previous trips, our entire time was now spent north of Camp I. My guide opened up a hunting trail, long disused, leading from Camp I to the top of the Cordillera, extending along this a few miles to the east (with a view of the Pacific on the right and the Atlantic on the left), and then descending the north side a short distance. At every few feet of ascent a brand new lot of ferns would appear. My guide would open up my press while I would walk about within a radius of a few yards and gather a generous number of specimens of each species. As soon as we had amassed a sufficiently large bundle, we would tie it up and leave it by the trail to be picked up on the return trip. The accompanying photograph shows my guides in the densest part of this jungle.

The intensely humid character of this portion of the forest is almost beyond description. The whole atmosphere was wet and clammy and bubbles of yellowish water were slowly collecting and dripping off the tips of the ferns. The tree-trunks were covered with moss and masses of filmy ferns, all as saturated as the wettest sponge.

After spending two days in this portion of the Cordillera, we followed Holcomb's trail itself to its summit and down the Atlantic side for three or four miles.

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* The localities along Holcomb's Trail have been discussed briefly by Mr. Maxon in a paper entitled, "A Remarkable New Fern from Panama," Smiths. Misc. Coll., Vol. 56, No. 24, pp. 1–5, pls. 1–3, Nov. 22, 1911.

My guides in the humid forest of the Cordillera, Province of Chiriqui, Panama

A somewhat less intensely humid forest was here met with, and the fern flora was slightly different from that of the two preceding days.

The great quantities of ferns collected in the Cordillera region of Boquete have not yet been determined, so detailed mention of the species must be deferred. On some future trip to Panama I hope to have an opportunity of exploring the Darien region, that vast, little-known country lying near the Columbian boundary, containing Indian tribes, through whose territory passage has been persistently denied to the white man.

In conclusion I certainly must express my very great gratitude to Mr. William R. Maxon for determining the ferns collected, as well as to Mr. A. S. Hitchcock and Mr. Paul Standley for going over other botanical specimens gathered. I very greatly appreciate, also, the kindness shown me by the Panama Canal officials, and by Mr. H. J. Watson and Col. and Mrs. E. H. Cuthbert, of Boquete.

ON BOARD S. S. "PANAMA,"
EN ROUTE TO NEW YORK, MAY 28, 1918.

Texas Pteridophyta—I.

ERNEST J. PALMER

While making general collections of plants in the Southwest for the Missouri Botanical Garden and Arnold Arboretum during the past few years, I have had an opportunity to observe many of the ferns of Texas in their native environments and to note their distribution over wide areas. Although the present list, perhaps, adds nothing new, unless it be Lycopodium, to the reported fern flora of the state, it may be worth while to place on record a number of new localities for some of the species.

The entire area of Texas, excepting that portion lying west of the Pecos River, was more or less thoroughly explored. As many species of ferns are found only in that region they are necessarily excluded from the list. In the portion of the state east of the Pecos thirty-seven species of ferns and ten species and one variety of fern allies were found.

There are two quite distinct fern floras in this region. The eastern part of the state receives an abundant rainfall; over most of the area east of the ninety-seventh meridian the annual precipitation ranges from forty to sixty inches. This is a region of low elevations, with few outstanding relief features, and for the most part it is heavily forested. The geological formations are comparatively recent, ranging from the Upper Cretaceous through the Tertiary and Quaternary. They consist largely of unconsolidated clastics, clays, sands, gumbo and alluvium covering most of the surface, but occasionally there are local outcrops of sandstone, ironstone or marly limestone. Swamps, bogs, bayous and sluggish streams prevail. In such a region moisture and shade-loving ferns naturally predominate.

To the westward the rainfall diminishes gradually, the annual total amounting to only fifteen or twenty inches at the one-hundredth meridian. The northwestern part of the state is occupied by the Plains, and is almost destitute of ferns except for a few species in the deep canyons. To the east is the somewhat broken, rocky and sparsely forested area of Paleozoic rocks, and the black prairies, underlaid by Upper Cretaceous deposits. Very few ferns are found in the prairie region. To the south is the Coastal Plain, extending far up the Rio Grande. To the north of this, and occupying a large area in the southwestern part of the state, is the rocky, semi-mountainous country of the Edwards Plateau, with bold relief features carved

from the limestones of the Comanchean series of Lower Cretaceous age. Over a limited area in Burnet, Llano and Mason Counties igneous rocks, principally granite and ryolite, occur.

The ferns of this region are largely xerophytic, but a few species common to the eastward have been able to adapt themselves to changed conditions and to maintain themselves along the perennial streams in the deep canyons of the Edwards Plateau, where there is abundant evidence that the forest flora of the Coastal Plain formerly extended.

The serial numbers of collections refer to specimens deposited in the herbarium of the Missouri Botanical Garden, while several sets of duplicates were made of most of them. During two collecting seasons lists were made of ferns noted in addition to specimens collected.

MARSILEACEAE

MARSILEA VESTITA Hook. & Grev. Southerland Springs, Wilson County, 10803; Campbelton, Atascosa County, 11245; Cotulla, Lasalle County, 11299; Uvalde, Uvalde County, 13350; Herrington, Brazos County, 13444; Byrd, Dimmit County, 13548; Quarry, Washington County; Sabinal, Uvalde County; Brownwood, Brown County; Alice, Jim Wells County.

This species appears to be quite common in Southwestern Texas. It is usually found in river bottoms, growing in stiff, black, waxy soil, in ditches and slight depressions, inundated during part of the year and becoming very dry later in the season. As the water recedes or dries up the Marsilea fronds spring up, the plants fruit and then die down and remain dormant until again irrigated. At Byrd, Dimmit County, it was found in rather well drained sandy soil. Some of the plants are quite robust and densely clothed with

white hairs on both surfaces, strongly suggesting *Marsilea macropoda*, but wherever it has been found in fruit the sporocarps were solitary.

MARSILEA UNCINATA A. Br. Uvalde, Uvalde County, 11038; San Saba, San Saba County, 11804; Manchaca, Hays County, 12148; Stone City, Brazos County, 13465; Byrd, Dimmit County, 13548; Blanco, Blanco County; Austin, Travis County.

Marsilea uncinata is usually found along spring branches, margins of permanent pools, or where there is a perennial water supply.

SALVINIACEAE

AZOLLA CAROLINIANA Willd. Liberty, Liberty County, 8560; Pledger, Matagorda County.

Grows in still water of swamps and bayous. Probably common near the coast and in Southeastern Texas.

EQUISETACEAE

EQUISETUM HYEMALE L. Columbia, Brazoria County, 5011; Dayton, Liberty County, 9606; Lindendale, Kendall County, 9902; Blanco, Blanco County, 11571; Canyon, Randall County, 12522; Barksdale, Edwards County, 13527; Gamble's Ranch, Armstrong County, 13931; Stephensville, Erath County, 14186; Houston, Harris County.

Found along moist, usually sandy, banks of streams.

EQUISETUM HYEMALE var. ROBUSTUM (A. Br.) A. A. Eaton. Menard, Menard County, 11851; Houston, Harris County, 11940.

In similar situations to the species.

EQUISETUM LAEVIGATUM A. Br. Junction, Kimble County, 10927.

Specimens referred to this species, but may possibly be only a form of the last. Growing on moist, calcareous banks of upper San Saba River.

LYCOPODIACEAE

LYCOPODIUM ADPRESSUM (Chapm.) Lloyd & Undw. Grapeland, Houston County, 13187; Keechi, Leon County, 13400; Oakwood, Leon County, 13416.

Growing in sandy bogs with *Triantha racemosa*, *Pogonia divaricata*, *P. ophioglossoides*, *Sarracenia flava*, *Rhexia flava*, *Oxypolis filiformis*, and several other southeastern plants, rarely found in Texas.

SELAGINELLACEAE

SELAGINELLA APUS (L.) Spring. Lacey's Ranch, Kerr County, 9286; Utopia, Uvalde County, 11524; Blanco, Blanco County, 11569; Boerne, Kendall County, 12244; Grapeland, Houston County, 13197.

At Grapeland, Houston County, this species was found growing in sandy bogs. Throughout the Edwards Plateau it is found on springy calcareous banks of streams.

SELAGINELLA ARENICOLA Underw. Fletcher, Hardin County, 9540; Keechi, Leon County, 13411.

Growing in deep, almost pure, sands.

SELAGINELLA RUPESTRIS (L.) Spring. Leakey, Real County, 10146; Devils River, Valverde County, 11389; Del Rio, Valverde County; Utopia, Uvalde County; Blanco, Blanco County; San Saba, San Saba County; Boerne, Kendall County; Montell, Uvalde County; Rock Springs, Edwards County.

On exposed limestone rocks and ledges.

SELAGINELLA LEPIDOPHYLLA Spring. Del Rio, Valverde County, 12364; Devils River, Valverde County, 11366; Montell, Uvalde County.

A Mexican species found on dry limestone ledges of high hills.

OPHIOGLOSSACEAE

OPHIOGLOSSUM VULGATUM L. Marshall, Harrison County, 13215.

This species appears to be quite rare in Texas and is probably limited to the moist, heavily forested eastern section. The specimens collected were growing in rich, alluvial soil of low woods along a small creek. This was compared with a large series preserved in the herbarium of the Missouri Botanical Garden, and, curiously, it, with an identical form collected by the writer at Natchitoches, Louisiana, 7482, and one collected by John H. Kellogg at Fulton, Arkansas, approximate in form and general appearance specimens from central and northern Europe much more closely than they do most of the American material referred to this species.

OPHIOGLOSSUM ENGELMANNII Prantl. San Augustine, San Augustine County, 7102; Brownwood, Brown County, 11432; Houston, Harris County, 11447; Austin, Travis County, 13667.

This species, although it has often been confused with the last in collections, is readily distinguishable by its fleshy, dull green sterile fronds, with apiculate apex, and its usually shorter, stockier habit of growth. It is generally found in large colonies, in thin soil, on limestone ledges or barrens. The specimens from Palestine were growing on knolls in low woods, and those from College Station and Houston in stiff, black soil, in woods near streams. The species is apparently common and widely distributed in Texas.

WEBB CITY, MO.

(*To be continued*)

Notes and News

Mr. G. P. Van Eseltine has published a study of the species of Selaginella allied to *S. rupestris* and occurring in the southeastern United States—that is, the region covered by Small's Flora, extending from the southern boundary of Virginia to Florida and west to the 100th meridian.[1] He recognizes eight apparently well-distinguished species. Most of them are local and of restricted range and, until recently, have been only scantily collected—facts which may help to explain why plants so different as these in appearance as well as in minute characters were for many years allowed to pass as belonging to a single species.

Each species is illustrated by half-tone plates from photographs which show excellently its habit and whatever else photographs can show, and also by line drawings of enlarged details. These are faithful and apparently exact in their representation of essential characters, but obscure rather than emphasize these characters by over-use of coarse shading.

At the semi-centennial of the Torrey Botanical Club in 1917, Dr. J. K. Small presented a brief general paper on the ferns of tropical Florida which, he then stated, was to serve later as an introduction to a more detailed treatment. This has now been published in a little book of 90 pages—a book which any lover of ferns who visits southern Florida will do well to take with him.[2]

The preface, containing the substance of the semi-centennial paper, gives a brief but excellent account

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[1] Van Eseltine, G. P. The allies of *Selaginella rupestris* in the southeastern United States. Cont. U. S. Nat. Herb. **20:** 159–172, *pls. 15–22, figs. 63–70.* **1918.**

[2] Small, J. K. Ferns of Tropical Florida. New York: published by the author. Pp. x, 80, *pls. 1–5, 51 text figs.* 1918. The introduction, as given at the semi-centennial, was published separately in the Amer. Mus. Journ. **18: 126–134. Feb.,** 1918.

of the physical and geological features of the region covered. There follow descriptions of the 51 species known to occur there, with a text illustration of each and notes as to their habitat, date of discovery in Florida and range elsewhere. There are also five half-tone plates from photographs by the author, showing certain species of ferns in situ.

Tropical Florida, as limited by Dr. Small, includes only the two groups of limestone and coral islands known as Keys—one situated in the southeastern part of the Everglades, the other off the coast. Their combined area is a very small portion of that of Florida as a whole, and the variety of soil and other physical conditions which they present is slight, yet they "harbor more than fifty per cent. of the fern flora of Florida." Of the 51 species recorded (46 of true ferns and 5 of fern-allies) only four—*Osmunda regalis*, *Anchistea virginica*, *Dryopteris Thelypteris* and *Lycopodium adpressum* —appear in northern floras. The rest are species of tropical America, in a very few cases peculiar to this region, and in all occurring in the United States only in Florida.

The text illustrations by Miss Mary E. Eaton deserve more than a word of praise. In spite of their small size, they are excellently clear; and they are both life-like and accurate. Sometimes, one suspects, they are almost too accurate for the author's comfort—as where the precisely similar venation of *Campyloneuron angustifolium* and *Phymatodes exiguum*, as figured, leaves only habital characters to separate these two genera and casts obvious doubt on their validity.

Ever since D. C. Eaton's time, various botanists have, on different occasions, expressed their dissatisfaction with the current classification of the lip-ferns of the southwestern United States, commonly referred

to *Cheilanthes myriophylla* and to *C. Fendleri*. Mr. Maxon has now dealt with the question thus raised; and, by attention to certain characters, chiefly of scales, rootstock and hairs, which were mostly overlooked or misunderstood by earlier botanists, he has produced a clear and logical treatment of this hitherto confused group, which accounts satisfactorily for all of the mate, rial now at hand.[3] He finds that true *C. myriophylla*, a species originally described from South America, does not occur in the United States; but that we have four species, two of them hitherto undescribed. They are: a plant related to *C. Clevelandii*, common in California and extending into Nevada and Arizona, which is now named *C. Covillei* and in which one subspecies, *C. Covillei intertexta*, is recognized; *C. Fendleri*, of Texas, Colorado, New Mexico and Arizona; *C. Wootoni*, of New Mexico and Arizona, similar in habit to the last, but distinguished by the ciliate scales of the under surface of the frond; and *C. villosa* Davenp., of Texas, New Mexico, Arizona and adjacent Mexico, the only one of the four which is closely related to *C. myriophylla*.

Present-day intensive study is rapidly reducing the number of reputedly cosmopolitan species and even of those which have been assigned a wide and discontinuous range in more than one continent. This result is due, not so much to finer-drawn conceptions of species as to the growing use in classification of certain characters of scales, pubescence and structure of indusium which were very generally neglected by the earlier writers on ferns, but which, when tested with the large number of specimens now available, have proved to be among the most reliable and satisfactory

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[3] Maxon, W. R. The lip ferns of the southwestern United States related to *Cheilanthes myriophylla*. Proc. Biol. Soc. Washington **31**: 139-152. Nov. 29, 1918.

means of distinguishing species. And the resultant breaking-up of too widely spread and heterogeneous groups is adding much to our knowledge of the real laws of plant distribution.

The latest American fern to be separated from the European species with which it had long been associated, is the local Polystichum of California, hitherto referred to *P. aculeatum*. This, Mr. Maxon finds after a study of abundant material, differs constantly from the European plant in its "invariably oblique, less strongly auricled and more copiously filiform-paleaceous pinnules and by its fimbriate-ciliate indusia." It must, he concludes, be considered a separate species and he names it *Polystichum Dudleyi*, in honor of the late Prof. W. R. Dudley.[4]

Prof. E. W. Berry has discussed a fossil fern, *Clathropteris platyphylla*, which, if his tentative restoration of it is correct, possessed a most peculiar habit. The main rachis, as pictured by him, divides into two branches which diverge at a wide angle. Each branch bears near the base from ten to thirty lanceolate pinnae, all on one side, in a fashion irresistably suggesting the feathers on the leg of a chicken. Above these pinnae the branches are naked for a space and then carry out the chicken analogy by producing at the end a palmately arranged cluster of pinnae which does very well for the foot.

Prof. Berry discusses interestingly the relationships of the genus Clathropteris. In the form of its pinnae and its, for the most part, regularly reticulate venation it is very like the present genus Drynaria, though it seems actually not to be related to it, but to represent the ancestral type of Dipteris.[5]

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[4] Maxon, W. R. A new Polystichum from California. Journ. Washington Acad. Sci. **8**: 620–622. Nov. 19, 1918.

[5] Berry, E. W. Notes on the fern genus Clathropteris. Bull. Torrey Bot. Club **45**: 279–285, *figs. 1 and 2*. July, 1918.

Elizabeth Wuist Brown describes an experiment undertaken to see if regeneration (that is, the replacing of destroyed organs by the living plant) could be brought about in a fern—it having been reported by a previous investigator that this was possible with the young, but not the mature, leaves of certain ferns.[6] The species chosen for the experiment was *Phegopteris polypodioides*. Spores were sown and when the young plants began to develop, leaves were cut from them and placed on sand wet with a nutrient solution and kept constantly in a damp atmosphere. Out of a large number of leaves so treated, one case of regeneration was obtained. In this instance, the petiole of the young leaf produced two cellular structures similar to prothallia. These bore no sexual organs, but presently put forth rhizoids and young leaves very similar to those produced by the prothallia of this species under normal conditions.

The author draws no particular conclusions from this single case, except that the possibility of regeneration and to some degree its extent and direction, are dependent on the nutriment available for the plant.

Dr. W. N. Steil has described a method of staining fern antherozoids so as to show their structure, which should be interesting to those engaged in microscopical study.[7]

C. A. W.

ADIANTUM CAPILLUS-VENERIS L. forma **cristatum** f. nov. Differing from the species in having the tips of the fronds more or less dichotomously forking and crested. Eaton Canyon, San Gabriel Mts., Los Angeles County, Cal., September 3, 1917. Geo. L. Moxley,

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[6] Brown, Elizabeth Wuist. Regeneration in *Phegopteris polypodioides*. Bull. Torrey Bot. Club **45:** 391–397, *fig. 1*. Oct., 1918.

[7] Steil, W. N. **A method for staining antherozoids of ferns.** Bot. Gaz. **65:** 562–563, *fig. 1*. June 18, 1918.

628a. While this form is not at all common, I found some dozen or fifteen fronds in the course of a half hour's search, growing with the species.

GEO. L. MOXLEY.

On June 30, 1918, while climbing Mt. Cushman in the town of Rochester, Vermont, I came across plants of *Aspidium Filix-mas* (L.) Sw. at an elevation of about 2400 feet. These plants were along an old roadway which leads from the Randolph divide road to the bare part of the summit of Cushman. But a few rods away was growing *Aspidium spinulosum* var. *dilatatum* (Hoffm.) Hook. forma *anadenium* Robinson.

The Filix-mas was growing in partial shade.

H. G. RUGG.

American Fern Society

Mr. Raynal Dodge, known to the fern students as the discoverer of *Dryopteris simulata* and of the hybrid character of *D. cristata* × *marginalis*, died at his home in Newburyport, Mass., October 21, 1918.

Mr. Dodge was born in Newburyport September 9, 1844. He served in the Civil War, enlisting, at the age of eighteen, in a Massachusetts regiment and serving in the expedition to New Orleans and at the siege of Port Hudson. For many years he had been employed as a machinist in a comb factory at Newburyport, and had shown no little ability in designing and constructing mechanical devices.

Mr. Dodge's interest in natural history was life-long. Even during his military service he devoted such time as he could command to observations on the flora and fauna of Louisiana. On his return home he set earnestly to work to prepare himself for serious scientific study. With little

assistance from others, he learned sufficient Latin and Greek to understand their technical uses and acquired a good reading knowledge of French and German. For years most of his spare time was spent in the fields and he built up an extensive knowledge of the natural history, in almost all its branches, of the region accessible to him; knowledge which he put freely at the service of all inquirers.

His special interest in fern-worts dates, he has said, from about 1890. With true scientific instinct, he was attracted to groups which were imperfectly known or offered especial difficulties, such as the quillworts, some of the grape-ferns and the hybrids in Dryopteris; and he was able to add something to our understanding of each of the groups he particularly studied. He published several papers in periodicals and a well-known book on the ferns and fern-allies of New England.

ANNUAL REPORTS OF THE SOCIETY

Not all of the officers' reports for 1918 had been received by the editors at the time of going to press. Such of them as are at hand are printed below; the others will follow as received.

Report of the Secretary for 1918

There is little to tell of the past year. Although it was the twenty-fifth since the founding of the Society, no effort was made to mark the anniversary, as might have been done in other times, except by a historical article soon to appear in the JOURNAL. No meetings have been held and no special activities undertaken. But the regular work of the Society has gone on about as usual.

The Secretary has received information of three members of the Society who have been in active service during the war. They are: Mr. Walter Mattern, with the engineers, and Messrs E. P. Killip and M. E. Woodams with machine-gun units. All three have been in France. The Secretary earnestly requests any other members of the Society who have been in the Army or Navy to notify him, so that due record may be made.

During the year two members, Messrs C. K. Dodge and Raynal Dodge, have died. Ten have resigned and six have been dropped for non-payment of dues. 13 new members have been received. The number of members at the date of this report (Dec. 31, 1918) is 265, a loss of five from last year. This loss is doubtless due to external conditions: it can soon be more than made up if all the members will work their neighborhoods for new recruits as thouroughly as a few have done theirs.

After a service of five years, the present Secretary quits office the richer for many pleasant memories and new and valued acquaintances and with hearty gratitude to the officers and members with whom he has worked for their generally cordial coöperation with and kindness toward him. He wishes the new Council and the Society under their leaedrship all possible prosperity and success.

C. A. WEATHERBY, *Secretary*

Report of the Editors for 1918

War conditions first and later influenza have considerably slowed up the work of publishing the JOURNAL both at the printers' end and that of the editors, and also in the intermediate stage of transportation. As a result, all the numbers for the year have been more or less late.

For this the editor chiefly concerned with the make-up of the JOURNAL apologizes (the other two have nothing to apologize for) and begs the indulgence of the members. He will try to do better in the future.

War conditions and the new interests and duties which they have brought to many of us also tended to reduce the abundant stream of copy which has hitherto flowed in to the JOURNAL. We end the year with about enough articles on hand to fill one number, but no more, and with the once flourishing notes and news department at the point of death from lack of sustenance. Articles and notes, long and short, from the members, will therefore be especially welcome: "more copy" is our message to them this year.

As for money, we always want that.

R. C. BENEDICT
E. J. WINSLOW
C. A. WEATHERBY

Editors

Report of the Curator for 1918

If one may judge of the activities of the Society by the interest of its members in the herbarium, the past year has not been one full of enthusiastic study of Pteridophytes.

Only two members have made use of material in the herbarium and only two accessions have been made to it.

Mr. D. LeRoy Topping has sent a splendid collection of about three hundred sheets mainly from North Borneo. Mr. J. B. Flett has collected some eighteen or twenty species of interesting material from Mt. Rainier National Park a set of which will be added to the Society herbarium. These, with a few miscellaneous sheets added by the curator, make up the sum total of the additions during the year.

L. S. HOPKINS, *Curator*.

Report of the Judge of Elections

TO THE SECRETARY OF THE AMERICAN FERN SOCIETY:

The undersigned, Judge of Elections by appointment of Acting President Mary A. Noble, respectfully presents the following report of the balloting for officers of the American Fern Society for 1919:

Whole number of ballots cast	73
Number of complete ballots	71
Number of incomplete ballots	2
Necessary for choice	37

For President

William R. Maxon	72
William Palmer	1

For Secretary

Stewart H. Burnham	71
C. A. Weatherby	1
Miss Nellie Mirick	1

For Vice-President

Mrs Mary A Noble	71
William R. Maxon	1
Rev. John Davis	1

For Treasurer

J. G. Underwood	71
Blank	2

I therefore declare the election of William R. Maxon President, Mrs. Mary A. Noble Vice-President, Stewart H. Burnham Secretary, and J. G. Underwood Treasurer, of the American Fern Society for the year 1919.

M. A. MARSHALL

STILL RIVER, MASS.
November 12, 1918.

The Treasurer's report, received to late for inclusion in this number of the JOURNAL, shows receipts of $291.65 and expenditures of $266.37 during 1918. The total balance on hand, including all funds except the permanent fund, is $167.33. The full report will be printed in the next number.

Last year, from motives of economy and patriotism, the Council decided not to print a full list of members in 1919. A list giving all changes to date will, however, soon be issued.

American Fern Journal

Vol. 9 APRIL–JUNE, 1919 No 2.

Early Days of the American Fern Society

E. J. WINSLOW

It is not especially fitting that I should assume the office of historian, as it was not until after more than nine years of the Society's existence that I became a member. And I find that not less than forty-four of the names on our membership roll have been there longer than mine. It is my hope that these disjointed fragments, recalled from the past in recognition of the twenty-fifth anniversary of the founding of the American Fern Society may be, as it were, a breaking of the ice, to be followed by contributions, perhaps from our three remaining charter members, or from some of the other forty or more who have "come down to us from former generations."

I began the study of ferns at about the beginning of the present century, and sometime early in 1902 discovered with some surprise that a flourishing society of one hundred or more members had been organized to promote this study. My dollar was promptly sent in and in due time I received a very cordial letter of welcome from Treasurer James A. Graves.

At the tenth anniversary of the founding of the Society President B. D. Gilbert wrote a "Historical Sketch of the Linnean Fern Chapter" which appeared in the Fern Bulletin for October 1902. This article contains the following account of the origin of the Fern Chapter,

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[Vol. 9, No. 1 of the JOURNAL, pages 1–32, Plates 1 and 2, was issued March 14, 1919.]

as it was then called. "Early in 1893, Mr. Willard N. Clute, Mr. J. A. Graves, Mrs. A. D. Dean and Mrs. T. D. Dershimer, all lovers of ferns, but not at that time skilled students of them, conceived the idea of starting a chapter of the Agassiz Association for the scientific study of ferns by correspondence. The charter was held open during the summer of 1893, and by autumn there were nineteen members with which number the Chapter started. At first there was no published Bulletin to disseminate the knowledge gained, but written notes were circulated by mail among the members. This plan, however, was not found to be very satisfactory and in July, 1893, the first number of an exceedingly modest little pamphlet was published, bearing the inscription; "The Linnean Fern Bulletin, No. 1. Published by the Linnean Fern Chapter. Price Five Cents. Binghampton, N. Y., 1893."

The Bulletin was edited throughout the twenty years of its existence by Mr. W. N. Clute, the first president and the leading spirit among the founders of the Society. It grew to be a noteworthy publication, and its periodical appearances were landmarks in the history of the Society during many years.

The fifth number of the Bulletin contained the constitution of the Chapter. That the makers of this constitution did not foresee the world wide expansion to which their organization was destined is evident from the following section. "Art. III, Sec. 3—Applications for membership must be made to the Secretary, who shall give notice to all members in good standing of such application and request a vote thereon. Two adverse ballots shall exclude."

Among the contributors to the early numbers of the Bulletin were, besides the four founders above mentioned, C. E. Waters, C. F. Saunders, A. J. Grout and others whose names are familiar to many of us. The number

for July 1896, contained an account of the discovery of *Aspidium simulatum* by Raynal Dodge with Plate i, a drawing of this newly discovered fern. In the same number was a paragraph on *Aspidium cristatum* × *marginale* by Geo. E. Davenport. With the issue for July 1898 began A. A. Eaton's series of articles on the Equisetums. This ran through seventeen numbers and with the accompanying distribution of illustrative material, was one of the notable events of the history of the Society. Perhaps a matter of still greater popular interest was the series of fern floras of the states. Beginning in January 1903 with the flora of Louisiana by W. N. Clute and R. S. Cocks the series continued with Texas by Julian Reverchon, Iowa by T. J. and F. L. Fitzpatrick, Washington by J. B. Flett, New York by B. D. Gilbert, California by S. B. Parish, Florida by A. H. Curtiss, Kentucky by Sadie F. Price, Montana by T. J. Fitzpatrick, Georgia by R. M. Harper, Vermont by W. W. Eggleston, Connecticut by C. H. Bissell, Ontario by A. B. Klugh, Maine by Dana W. Fellows, Ohio by Lewis S. Hopkins, Pennsylvania by W. A. Poyser, Indiana by F. C. Greene, Michigan by C. K. Dodge, and Illinois by E. J. Hill.

The establishment of a Society Herbarium was first suggested by A. A. Eaton in his address upon assuming the presidency in 1899. He assumed the work of Curator and continued it until his death ten years later, when our present Curator, L. S. Hopkins, was appointed. So there have been but two occupants of this office in twenty years.

In June, 1903, I attended a meeting of the Josselyn Botanical Society in Skowhegan, Maine. At this time the Bulletin was running a series of photographs and short biographical sketches of well known fern students. And so it happened that I was able to identify a gentleman whose keen spectacled eyes were constantly search-

ing from the car window the banks and pools along the railroad as we journeyed toward our place of meeting. It was A. A. Eaton, who was on the program for an evening lecture on the New England Ferns. At the Skowhegan meeting I also made the acquaintance of Dr. Dana Fellows, a former vice-president of the Chapter, Mr. E. B. Chamberlain, for many years past the mainstay of the Moss Society, and several others whom I now count as old acquaintances.

Eaton had recently named *Botrychium tenebrosum* which he described as a species and vigorously defended in the pages of the Fern Bulletin against the attacks of Geo. E. Davenport who insisted that it was a form of *B. matricariaefolium*. During the social hour following his lecture some of the lady botanists playfully rallied him upon his temerity in opposing so high an authority as Davenport. Eaton replied modestly, expressing great respect for Davenport's knowledge of the subject, but adding that he could not disregard the facts as he found them.

A year or two later Eaton visited me in Vermont, where he had gone to look for certain orchids. And I called upon him several times at his home in North Easton, Mass. to get his help on some fern problems. He was working upon a revision of the genus Isoetes at this time and had several species growing in pots in the dooryard.

He used to correspond by postcard in a telegraphic style designed to condense much into a few words. On a card dated June 12, 1905, he writes, "Found simplex in a meadow of Ophioglossum here. Surprised. Thought it grew in dry ground. But I am of opinion Dr. Robinson is right and tenebrosum is ecological form of simplex. Though to tell the truth it is hard to reconcile all differences."

Much of my talk and correspondence with Eaton had reference to the various forms of Nephrodium, as we

were calling them at that time,—the odd spinulosums, Clintonianums and Boottiis. "They constitute the most interesting problem in New England ferns," he declared. When I visited him in the Massachusetts General Hospital, during his last illness, he said, "Some New York fellows have been describing some of those Nephrodium forms as hybrids."

At about the same time with the *Botrychium tenebrosum* controversy there appeared in the Bulletin a new phase of the irrepressible conflict between old Britain and young America in the form of a discussion between Mr. Chas. T. Druery of London and Mr. Clute on the comparative value of the American method of fern study and the British, which consists largely in seeking out and propagating sports or horticultural varieties. Although this discussion was brief, it was indelibly fixed in our minds by Clute's two-headed rabbit simile, which immediately took rank as a classic in fern literature.

In the year 1907, the Society lost three of its most valued members and most eminent fern students by the deaths of B. D. Gilbert, L. M. Underwood and Geo. E. Davenport. Gilbert had been president of the Fern Society, and endeared himself to many of us beginners by his enthusiasm and lively interest in whatever problem we submitted to him. Davenport was vice-president in 1902. Underwood, as the author of the manual of Ferns and Fern Allies, was perhaps the most widely known authority on the subject in America.

In 1910 it was decided that the Society should own and control its official publication, and the American Fern Journal, which had been started by Mr. R. C. Benedict, was adopted. This move was the subject of considerable controversy, but the event seems to have justified the venture. During the year 1911 the growth in membership exceeded that for any other year in the history of the Society. And though the four years of

the war have been unfavorable to the peaceful pursuit of fern lore, we have maintained our number somewhere near the 275 mark.

With twenty-five years of our development passed into history, we have a body of memory and tradition worth cherishing. And if the recently suggested plan of reprinting the early numbers of the Fern Bulletin should prove feasible it would be of a fitting celebration of the opening of our second quarter century.

AUBURNDALE, MASS.

Ferns of the District of Columbia[1]

WILLIAM R. MAXON

The flora of the District of Columbia, first brought to familiar notice by Ward's classic "Guide to the Flora of Washington and Vicinity,"[2] has to an unusual degree the interest always attaching to the plants of a limited region in which more or less definite life zones meet. This interest is reflected in the ferns and their allies.

The area adopted by Ward and by later botanists for the "District flora" is a circle of 15 miles radius, with the Capitol as its center. This includes the city of Washington, which is coextensive with the present District of Columbia, and very much more territory in adjacent parts of Maryland and Virginia. Roughly bisecting this territory obliquely, northeast and southwest, is the so-called "fall line" or common boundary separating the Coastal Plain and the lower foothills of the Piedmont Plateau, two regions which both geologically and physiographically are widely different throughout their whole extent along the Atlantic Coast,

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[1] Published with the permission of the Secretary of the Smithsonian Institution.

[2] Bulletin 22 of the U. S. National Museum. 1881.

and are well known to support characteristic floras. The interlocking of these zones along the fall line in the vicinity of Washington and the various factors controlling to a great extent the local distribution of plant and animal life are interestingly discussed by W. L. McAtee in a recent volume entitled "A Sketch of the Natural History of the District of Columbia and Vicinity."[3] Similar data are presented also in the forthcoming "Flora of the District of Columbia and Vicinity,"[4] by A. S. Hitchcock and Paul C. Standley, with the assistance of the botanists of Washington. In both works the more important collecting localities and their characteristic vegetation are described, and to these the reader is referred for fuller information. The list of species given below is deemed of sufficient interest to fern students to justify its publication separately, and it may besides serve a useful purpose to members of the Fern Society visiting Washington.

The local Piedmont area lies chiefly northwestward and includes most of Rock Creek Park and the upper Potomac region, extending from the Aqueduct Bridge at Georgetown to Little Falls, High Island, Cabin John, and the Great Falls of the Potomac, the last mentioned locality lying at the edge of the 15-mile circle. The soils of this region are derived by the disintegration of metamorphic rocks and are mostly neutral or but weakly acid. It is mostly broken country, characterized by sharp declivities and by frequent streams running rapidly between steep banks, and, especially in the near vicinity of the river, is beautiful and often picturesque. The abrupt wooded bluffs of the Virginia shore from Great Falls to a point opposite Cabin John are of especial interest as sheltering several of the rarer local ferns. *Camptosorus* occurs sparingly on

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[3] Bulletin No. 1, Biological Society of Washington. Pp. 142. 1918.

[4] Contr. U. S. Nat. Herb., Vol. 21. (In press.)

rock outcrops and mossy gneiss boulders of the shaded upper talus slopes; *Filix bulbifera* is found in two or three cool, well shaded situations at the foot of the talus; *Asplenium pinnatifidum* grows in earth pockets of the cliff at a single locality; *Pteretis nodulosa* occupies here and there considerable stretches of the shaded narrow belt of flood plain; and just above the last, especially at the mouth of the wooded ravines or "runs." *Athyrium pycnocarpon* and *A. thelypteroides* are locally abundant. The more exposed rocks of the summit and upper slopes are often covered by *Polypodium vulgare*, and the moister, lower areas of the talus slopes everywhere support large plants of *Dryopteris marginalis*. In one or two of the moist runs occur colonies of *Dryopteris Goldiana*. *Selaginella rupestris* is found in several rocky, open situations near Great Falls, and with it *Cheilanthes lanosa*. A single colony of *Asplenium montanum* occurs here also.

These records indicate very definitely the element of northern or mountain-loving species within the flora, and leave few additional species reasonably to be looked for, excepting *Asplenium Bradleyi* and *Athyrium angustum*.

The Coastal Plain region, lying mainly east of Washington proper and southward along the broad lower Potomac past Alexandria to Mount Vernon and Marshall Hall, is low and more nearly level, with contours mostly gentle, marking broad open valleys. The soils are inclined to be strongly acid. Much of this territory, like that of the Piedmont, is under cultivation; but there are also wide stretches given over to poison sumac and impassable cat-brier thickets, drained by sluggish streams, which only the most enthusiastic collector will explore in Washington's tropical dog-days, when the "jiggers" are at their worst.

The most interesting single feature of the local Coastal Plain area is the occurrence of the so-called magnolia bogs, well described by McAtee. These are small, open, gently sloping patches of white gravel underlaid by an impervious stratum of clay, their surface constantly irrigated by a thin sheet of water flowing from springs at the upper swampy border. Here are found a considerable number of typical pine barren plants, and here or in the near vicinity such "coastal" species as *Lygodium palmatum*, *Dryopteris simulata*, *Anchistea virginica*, *Lycopodium adpressum*, and, at a single locality, *L. carolinianum*—plants practically restricted to acid-soil situations. Since many such bogs doubtless await discovery, it is not unlikely that *Lycopodium alopecuroides* will be added eventually to the District flora.

Aside from the species mentioned above as practically limited to the Piedmont or to the Coastal Plain, there are many which occur generally throughout the local area, apparently showing no decided soil preference if exposure and drainage conditions are suitable. These are discussed in the following notes, which list 56 species, distributed among 25 genera. The list is not an unusually long one, but nevertheless is equal to that of many larger areas.

The city of Washington has grown rapidly in recent years, trolley lines stretching out to numerous small suburbs and far beyond them. Many still unspoiled woodlands are thus to be found within the city limits, and the more distant collecting grounds also are reached very quickly and easily. Two of the lines extend to Great Falls on opposite sides of the river, and a third parallels the river to Cabin John. The Chesapeake and Ohio Canal skirts the river, also, on the Maryland side, all the way to Great Falls, affording the easiest possible access to that wild region. Because of its

attractiveness, the upper Potomac gorge and adjacent bluffs have not unnaturally been explored more completely than other local regions; but the entire territory of the "District flora" is of very great interest, whether to the resident or visiting botanist, and will richly repay field study for many a year to come.

OPHIOGLOSSACEAE

OPHIOGLOSSUM VULGATUM L. Low moist woods or partially shaded, grassy slopes; nowhere common, though found at numerous localities. Just outside our area, at Chesapeake Beach, it occurs in great abundance, however.

BOTRYCHIUM VIRGINIANUM (L.) SWARTZ. Abundant; best developed in rich hilly woods on the Virginia side of the upper Potomac. First of June.

BOTRYCHIUM OBLIQUUM MUHL. Low, brushy pastures and moist, thin woods; common.

BOTRYCHIUM DISSECTUM SPRENG. Moist woods and thickets; common, but decidedly less so than *B. obliquum*.

(*Botrychium neglectum* Wood has been reported, probably in error.)

OSMUNDACEAE

OSMUNDA REGALIS L. Swamp borders and boggy or wet sandy woods; not uncommon, but as a rule lacking the vigorous appearance and large size of more northern plants.

OSMUNDA CINNAMOMEA L. Wet woods, swamps, and low, partially cleared areas; abundant.

OSMUNDA CLAYTONIANA L. Swamp edges, moist wooded slopes, or sandy alluvial soil; not very common, but found throughout.

SCHIZAEACEAE

LYGODIUM PALMATUM (BERNH.) SWARTZ. Wet "catbrier" thickets and borders of low woods; several re-

stricted localities in the Coastal Plain, and probably of commoner occurrence. Occasionally offered for sale in Washington markets, where it is known as "Alice's fern."

POLYPODIACEAE

POLYPODIUM POLYPODIOIDES (L.) WATT. Shaded, flat, mossy rocks; gorge of the Potomac below Great Falls, Maryland side, the only locality. This species is here near its northern limit.

POLYPODIUM VULGARE L. Rocky banks or partially shaded cliffs; common along the upper Potomac and found in a few other localities.

ADIANTUM PEDATUM L. Rich, well-drained, rocky deciduous woods and shaded hillsides; common.

CHEILANTHES LANOSA (MICHX.) WATT. Earthy crevices of cliffs or rocky bluffs of the upper Potomac; rare; only three stations known, two of these near Great Falls.

PELLAEA ATROPURPUREA (L.) LINK. Several scattered stations; abundant at only one (Georgetown), here growing profusely in the mortar of an old retaining wall.

PTERIDIUM LATIUSCULUM (DESV.) MAXON.[1] Sunny, sandy slopes, low thin woods, or old fields, and acid soil situations generally; abundant. (*Pteridium aquilinum* of American authors, in part.)

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[1] Pteridium latiusculum (Desv.) Maxon.
Pteris latiuscula Desv. Mém. Soc. Linn. Paris 6: 303. 1827.
This appears to be the proper name for our common bracken of the eastern United States, which differs very definitely from the European *P. aquilinum* (L.) Kuhn in outline and cut of blade and in its nearly or quite nonciliate outer indusium, *P. aquilinum* having the outer indusium conspicuously and persistently long-ciliate. Desvaux's brief description is unsatisfactory. A photograph of the type specimen in the Paris Herbarium, recently received through the courtesy of Prince Roland Bonaparte, however, shows two incomplete fronds, labeled "T. N. et St. Pierre," that is, Newfoundland and the nearby island, St. Pierre, since Newfoundland material at hand agrees with the fronds shown in the photo-

ANCHISTEA VIRGINICA (L.) PRESL. Swamps: infrequent, the known localities all in the Coastal Plain.

LORINSERIA AREOLATA (L.) PRESL. Swamps and other low, permanently moist, shaded situations; not uncommon, but nearly restricted to the Coastal Plain. Late summer.

CAMPTOSORUS RHIZOPHYLLUS (L.) LINK. Shaded, mossy rocks in cool situations; a few localities along the Potomac, principally above Cabin John.

ASPLENIUM PINNATIFIDUM NUTT. Crevices and earth pockets of shaded cliffs; Virginia shore of the Potomac several miles below Great Falls; very rare.

ASPLENIUM EBENOIDES R. R. SCOTT. Crevices of shaded rocks; two records, Plummers Island and Virginia shore of the Potomac near Little Falls.

ASPLENIUM PLATYNEURON (L.) OAKES. Grassy or rocky banks and thinly shaded situations generally; abundant.

ASPLENIUM TRICHOMANES L. Crevices of cool, shaded cliffs and on mossy rocks; upper Potomac region chiefly; infrequent.

ASPLENIUM MONTANUM WILLD. Crevices of dryish rocks; a single station, above Great Falls on the Virginia side of river.

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graph and with the plant ranging southward through New England and the Appalachian region generally, there can be no reasonable doubt as to the application of Desvaux's name in this sense.

The related lowland plant occupying the periphery of the Piedmont region from Long Island along the Coastal Plain to Florida and the Gulf region where it alone occurs, and extending some distance up the lower Mississippi Valley, while for the most part recognizable as different from the upland and northern *P. latiusculum*, is highly problematical. It has been described as *Pteris aquilina pseudo-audata* Clute Fern Bull. 8: 39. 1900, the type being from Babylon, Long Island. Pending field study and the collection of further material it seems best to regard this as a subspecies only. **Pteridium latiusculum pseudo-audatum** (Clute) Maxon.

The plants of western North America also are very difficult of classification, largely, as it seems, because of inherent ability to adapt themselves in different ways to wide extremes of environmental and climatic conditions. They fall into several variable categories, none of which is precisely identical with the European plant, though they are for the most part more nearly related to that than to *P. latiusculum*.

ATHYRIUM PYCNOCARPON (SPRENG.) TIDESTROM. Moist, cool woods and shaded, alluvial banks; a few localities in Rock Creek Park and along the Potomac. (*Asplenium angustifolium* Michx.)

ATHYRIUM THELYPTEROIDES (MICHX.) DESV. Moist, rich woods, mainly in alluvial situations; fairly common, especially along the upper Potomac. (*Asplenium acrostichoides* Swartz.)

ATHYRIUM ASPLENIOIDES (MICHX.) DESV. Low woods, and moist thickets; abundant. (*Athyrium filix-femina* of most American writers, in part.)

DRYOPTERIS HEXAGONOPTERA (MICHX.) C. CHR. Dryish or well-drained deciduous woods; abundant; especially luxuriant in the rich woods of the upper Potomac, on the Virginia side.

DRYOPTERIS NOVEBORACENSIS (L.) A. GRAY. Moist, low woods and thickets; abundant throughout.

DRYOPTERIS SIMULATA DAVENP. Woodland swamps; Hollywood Swamp and near Suitland, Maryland; probably occurs also in other similar situations below the fall line. Late summer.

DRYOPTERIS THELYPTERIS (L.) A. GRAY. Marshes, stream banks, and low thickets; common.

DRYOPTERIS MARGINALIS (L.) A. GRAY. Talus slopes and rocky hillsides in rich woods; common, chiefly along the upper Potomac.

DRYOPTERIS CRISTATA (L.) A. GRAY. Swamps and moist or boggy thickets or thin woods; common.

DRYOPTERIS GOLDIANA (HOOK.) A. GRAY. Rich, deciduous woods; several stations along the upper Potomac, on both sides; rare.

DRYOPTERIS CLINTONIANA (D. C. EATON) DOWELL. Boggy woods; very rare; a single station (Lincolnia, Virginia).

× DRYOPTERIS BOOTTII (TUCKERM.) UNDERW. Moist, wooded ravines; several localities, mostly in "runs" of the upper Potomac.

DRYOPTERIS SPINULOSA (MUELL.) KUNTZE. Rich. low woods; common throughout.

DRYOPTERIS INTERMEDIA (WILLD.) A. GRAY. Moist or dryish woods; fairly common.

(The following hybrids besides *Dryopteris Boottii* have been collected: DRYOPTERIS CRISTATA×MARGINALIS Davenp.; two collections, near Great Falls, Va., *Dowell*. DRYOPTERIS GOLDIANA×MARGINALIS Dowell; woods near Kensington, Maryland, *Dowell*.)

POLYSTICHUM ACROSTICHOIDES (MICHX.) SCHOTT. Moist woods and cool, shady banks; abundant throughout the range. Easily the most conspicuous fern of the region, especially in winter, the thick evergreen fronds then closely carpeting the many gullies of Rock Creek Park and surrounding country.

ONOCLEA SENSIBILIS L. Moist, open or partially shaded, low situations generally; abundant.

PTERETIS NODULOSA (MICHX.) NIEUWLAND. Shaded, alluvial banks (both sides) and islands of the Potomac above Cabin John; rare. (*Matteuccia Struthiopteris* and *Onoclea Struthiopteris* of many American writers.)

FILIX BULBIFERA (L.) UNDERW. Shaded talus of cliffs, Virginia side of the Potomac in the region opposite Cabin John; very rare.

FILIX FRAGILIS (L.) UNDERW. Shaded, alluvial flats, rocky slopes, and moist woods; abundant in many localities, but chiefly along the Potomac.

WOODSIA OBTUSA (SPRENG.) TORR. Rocky banks and partially shaded cliffs; common, especially along the upper Potomac and the Canal, usually near water but always in well-drained situations.

DENNSTEDTIA PUNCTILOBULA (MICHX.) MOORE. Low woods and moist, thinly shaded banks; fairly common.

EQUISETACEAE

EQUISETUM ARVENSE L. Sandy, often alluvial soil; common; several forms.

EQUISETUM PRAEALTUM RAF. Alluvial banks of the Potomac and tributary streams; occasional patches, but not common.

LYCOPODIACEAE

LYCOPODIUM LUCIDULUM MICHX. Damp woods and springy wooded banks, sometimes in beds of sphagnum; infrequent.

LYCOPODIUM CAROLINIANUM L. Magnolia bogs; only a single locality known, in Prince George County, Maryland.

LYCOPODIUM ADPRESSUM (CHAPM.) LLOYD & UNDERW. Bogs and low, open fields, often in the shallow overflow of springs; abundant at several localities in the Coastal Plain.

LYCOPODIUM OBSCURUM L. Moist woods and thickets; a few scattering localities only.

LYCOPODIUM CLAVATUM L. Moist thickets and pine woods; rare; known only from three widely separated localities.

LYCOPODIUM COMPLANATUM FLABELLIFORME FERNALD. Pine woods and thickets, with *Pyrola*, *Chimaphila*, and *Mitchella;* fairly common.

LYCOPODIUM TRISTACHYUM PURSH. Damp pine woods and thickets; not uncommon.

SELAGINELLACEAE

SELAGINELLA RUPESTRIS (L.) SPRING. Exposed rocky bluffs; found only in the vicinity of Great Falls, on both sides of the Potomac.

SELAGINELLA APODA (L.) FERNALD. Low, moist situations, usually in partial shade; locally abundant, but very generally overlooked. (*Selaginella apus* Spring.)

ISOETACEAE

ISOETES ENGELMANNI VALIDA ENGELM. Temporary pools among rocks; Virginia shore of the Potomac near Great Falls; very rare.

ISOETES SACCHARATA ENGELM. Shallow water between tides, in gravel and sand; banks of the Potomac between Alexandria and Mount Vernon; variable, several forms having been described.

WASHINGTON, D. C.

The Simplest Fern in Existence

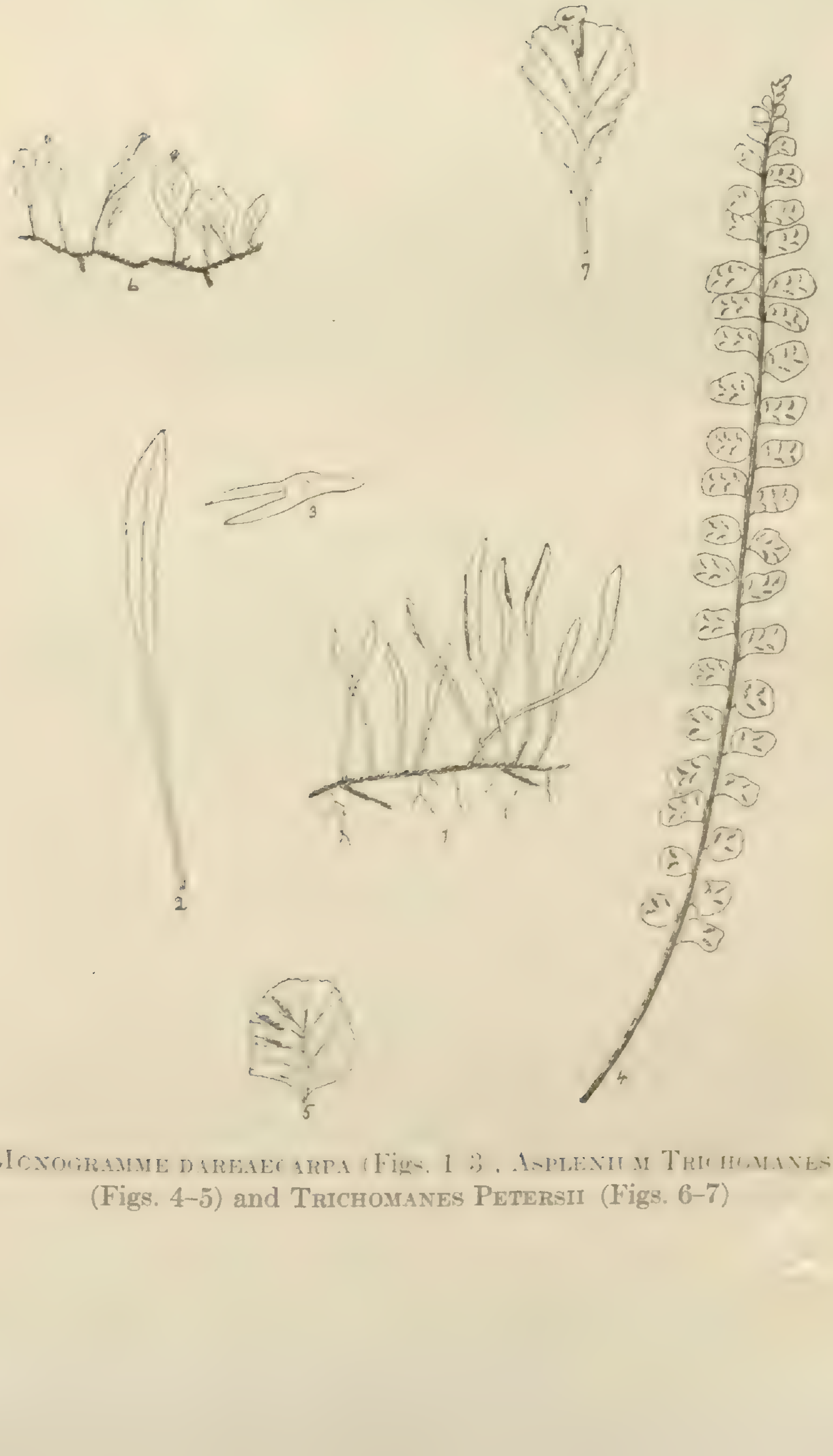
R. C. BENEDICT

What is the simplest fern in existence? It is not *Asplenium Trichomanes* with its short wiry midrib and small pinnae. It is not even *Trichomanes Petersii* with not much more than a pinna of leaf tissue and leaves one cell thick. These are perhaps the simplest ferns in the United States from the standpoint of size and structure. The simplest known fern is a native of the tropical East Indies, a species of the genus *Monogramme* Schkuhr, *M. dareaecarpa* Hooker.

In this plant, each leaf has but one vein and one fruit dot or fruiting line, set in a groove along one side of the leaf. The placing of the sporangia was responsible for the original specific name, *dareaecarpa*, after *Darea*, a group of ferns generally placed under *Asplenium*. The plants are epiphytic and grow mixed with mosses on the bark of trees. The stem, like the leaf, has a single solid wood fiber traversing it, only a few cells thick.

The relationship of *Monogramme* is with the fern tribe *Vittarieae*. *Vittaria*, a single species of which, *V. lineata*, occurs in Florida, always has two lines of sporangia while *Monogramme* has but one, but in venation, the largest species of *Monogramme* is almost a duplicate of the smallest *Vittaria*.

The other species of *Monogramme* are almost as simple as *M. dareaecarpa*. The first species discovered, *M. graminea*, from the Bourbon Islands off the coast of Africa, is like *M. dareaecarpa*, but with leaves three or



Mcnogramme dareaecarpa (Figs. 1–3), Asplenium Trichomanes (Figs. 4–5) and Trichomanes Petersii (Figs. 6–7)

four times as large. *M. subfalcata* of Borneo, is about the same size as *M. daraecarpa*, but has a once divided vein. *M. paradoxa*, widely distributed in Polynesia and eastern Asiatic regions, is the largest of the group, sometimes as much as six inches long, and has one or two divisions of its primary vein. The fifth species, *M. trichoidea*, is, as its name means, actually thread-like in structure and size, but longer than *M. daraecarpa*, and with one to three fertile portions along its length. It is rather common in collections of Philippine ferns.

The accompanying illustration (Plate 3) shows a plant of *M. daraecarpa*, life size (fig. 1) an enlarged leaf showing the single vein (fig. 2)and a still more enlarged section of the leaf showing the groove in which the sporangia are born (fig. 3). These figures are redrawn from the *Bulletin of the Torrey Botanical Club*, Vol. 38, Plate 3. With them are also illustrated a leaf of *Asplenium Trichomanes*, life size (fig. 4), and a pinna enlarged to show the venation (fig. 5), both drawn from an herbarium specimen, and a plant, life size (fig. 6), and an enlarged leaf of *Trichomanes Petersii* (fig. 7), redrawn from Plate 3 in Vol. 7 of the JOURNAL.

BROOKLYN, N. Y.

Texas Pteridophyta—II

ERNEST J. PALMER

BOTRYCHIUM OBLIQUUM Muhl. Marshall, Harrison County, 8644; San Augustine, San Augustine County, 7102 and 12706.

Found in low, wet woods at Marshall. A form, 8644a, growing with the other specimens, may be varietally distinct. A much reduced form, growing on rotten logs and hummocks in deep Tupelo and Cypress swamps at San Augustine, appears to represent a distinct and perhaps undescribed variety

BOTRYCHIUM VIRGINIANUM L. Livingston, Polk County, 5270; Marshall, Harrison County, 5301 and 13227; Lacey's Ranch, Kerr County, 9981; Palestine, Anderson County, 13425; San Augustine, San Augustine County; 13240.

Usually found in open woods or on rich, shaded hillsides. The specimens from Kerr County are far out of its usual range, but it is there associated with a number of other eastern herbs and trees of the Atlantic forest belt, which seem to have survived from an earlier period, in the deep protected canyons. The plants were growing in rich alluvial soil, near a spring branch and in partial shade.

SCHIZAEACEAE

ORNITHOPTERIS MEXICANA (Kl.) Underw. Concan, Uvalde County, 10189; Leakey, Real County, 10139; Barksdale, Edwards County, 11001; Fischers Store, Comal County, 12180; Montell, Uvalde County; Medina Lake, Bandera County; Utopia, Uvalde County; Devils River, Valverde County.

This species is usually found on dry, partially shaded, steep hillsides, on banks of dry ravines or under overhanging limestone ledges, in dry soil. It belongs to a flora that has come up from northern Mexico, and occupied the southern side of the Edwards Plateau.

OSMUNDACEAE

OSMUNDA REGALIS L. Milano, Milam County, 11683; Grapeland, Houston County, 12072; Marshall, Harrison County, 13216; Fletcher, Hardin County; Palestine, Anderson County; San Augustine, San Augustine County; Oakwood, Leon County.

Grows in wet, sandy woods, margins of sandy bogs, and on hummocks in deep swamps.

OSMUNDA CINNAMOMEA L. Milano, Milam County, 11684; Grapeland, Houston County, 12058; Palestine,

Anderson County; Fletcher, Hardin County; Marshall, Harrison County; Oakwood, Leon County.

Usually found with the last, but sometimes in rather drier situations.

POLYPODIACEAE

POLYPODIUM POLYPODIOIDES (L.) Watt. Columbia, Brazoria County, 4988; Livingston, Polk County, 5257; Houston, Harris County, 11446; Larissa, Cherokee County, 13365; Riverside, Walker County, 13171; Fletcher, Hardin County; San Augustine, San Augustine County; Huntsville, Walker County; Liberty, Liberty County; Oakwood, Leon County; Grapeland, Houston County.

Throughout its range in Texas this fern is usually found growing on trees, and apparently it has little preference as to species, providing they grow in moderately shaded and damp situations and have a rough, porous bark and wide-spreading or horizontal branches or inclined trunks, where the spores can find lodgment while germinating and a supply of moisture for some time after rains. Near the Gulf Coast the Live Oak (*Quercus virginiana*) serves its requirements most admirably, and it is often found upon species of *Tilia*. Occasionally it is found growing on rocks, where the spores have found lodgment amongst moss or lichens. The specimens from Larissa were found on ferrugineous sandstone boulders, and those from Riverside on sandstone bluffs.

PTERIS AQUILINA L. var. PSEUDOCAUDATA Clute. Livingston, Polk County, 5187; Milano, Milam County, 11690; Houston, Harris County, 11942; Marshall, Harrison County, 13217; Palestine, Anderson County; Oakwood, Leon County; Grapeland, Houston County; Huntsville, Walker County; Jacksonville, Cherokee County.

Very common in open, sandy woods and acid soils generally, throughout eastern Texas, where it sometimes covers acres of ground.

ADIANTUM CAPILLUS-VENERIS L. Boerne, Kendall County, 9269; Lacey's Ranch, Kerr County, 9980; Kerrville, Kerr County; Telegraph, Kimble County, 10941; Pulliam, Zavalla County, 11331; Devils River, Valverde County, 11381; Houston, Harris County, 11949; San Marcos, Hays County, 12103; Gamble's Ranch, Armstrong County, 13914; Utopia, Uvalde County; Blanco, Blanco County; San Saba, San Saba County; Manchaca, Travis County; Fischers Store, Comal County; Medina Lake, Bandera County; Barksdale, Edwards County; Paloduro Canyon, Randall County; Rock Springs, Edwards County.

This widely distributed southern fern, although occurring in the Ozark region of Arkansas and Missouri, appears to be absent from a large area in eastern Texas, the isolated station near Houston being very exceptional. In the canyons of the Edwards Plateau it grows in great luxuriance and abundance on the rocky margins of pools and limestone bluffs and ledges, kept perennially wet by seeping springs. The Houston station, discovered by Mr. Geo. L. Fischer, is along a deep, shaded spring branch, where there is an outcrop of somewhat calcareous Quaternary sandstone. In Randall and Armstrong Counties it is found, rarely, in deep spring-fed canyons, growing upon shale and sandstone of Triassic age.

PELLAEA ATROPURPUREA (L.) Link. San Augustine, San Augustine County, 7896; Spanish Pass, Kendal County, 9868; Kerrville, Kerr County, 9932; Lacey's Ranch, Kerr County; Leakey., Real County, 10158; Edwards County, 10967; Brownwood, Brown County, 11115; Blanco, Blanco County, 11572; Menard, Menard

County, 11789, 11887; Gamble's Ranch, Armstrong County, 13913; Stephensville, Erath County, 14179; Barksdale, Edwards County.

Grows amongst rocks and on rocky ledges of partially shaded ravines and hillsides. One of the most widely distributed ferns in the state.

PELLAEA WRIGHTIANA Hook. Llano, Llano County, 10284.

Growing here in clefts of sandstone, on dry hillsides.

PELLAEA ASPERA (Hook.) Baker. Lacey's Ranch, Kerr County, 10026; Laredo, Webb County, 11319; Menard, Menard County, 11886; Blanco, Blanco County, 12869, 13287; San Saba, San Saba County, 11799; Colorado, Mitchell County, 13778; Austin, Travis County, 13666; Kerrville, Kerr County; Sabinal, Uvalde County; Fischers Store, Comal County; Medina Lake, Bandera County; Barksdale, Edwards County.

In rocky clefts or under protecting ledges. Usually in limestone formations, but at Laredo and Colorado found in sandstone clefts.

PELLAEA PULCHELLA (Mart. & Gal.) Fée. Leakey, Real County, 10144; Concan, Uvalde County, 11554; Montell, Uvalde County, 12991; Chalk Bluff, Uvalde County; Barksdale, Edwards County.

Found on high limestone hills, on rather exposed ledges.

PELLAEA FLEXUOSA (Kaulf.) Link. Austin, Travis County, 9341; Lacey's Ranch, Kerr County, 10024; Leakey, Real County, 10140; Uvalde, Uvalde County, 11052; San Saba, San Saba County, 11790; San Marcos, Hays County, 12108; Sabina Creek, Kendall County, 13640; Manchaca, Travis County; Barksdale, Edwards County.

Grows in rather dry situations amongst limestone rubble or under ledges. At Uvalde it was collected amongst trap-rock (phonolite) rubble.

CHEILANTHES ALABAMENSIS (Buckl.) Kunze. Boerne, Kendall County, 9268, 9836; Sabina Creek, Kendall County, 13640; Telegraph, Kimble County, 10953, 10964; Brownwood, Brown County, 11413; Concan, Uvalde County, 11555; Quarry, Washington County, 11707; San Saba, San Saba County, 11788; San Marcos, Hays County, 12107; Manchaca, Travis County, 12139; Blanco, Blanco County, 12868; Utopia, Uvalde County, 12948; Montell, Uvalde County, 12990, 13005; Riverside, Walker County, 13161; Medina Lake, Bandera County; Barksdale, Edwards County.

Usually found on limestone hillsides, in clefts and under protecting ledges. The specimens from Quarry and Riverside were growing in clefts of coarse, Tertiary (Corrigan) sandstone. Its occurrence on this formation seems to be an eastward extension of its range in Texas.

CHEILANTHES MICROPHYLLA Sw. Leakey, Real County, 10157; Comstock, Valverde County, 11065; Montell, Uvalde County, 13013; Chalk Bluff, Uvalde County, 13336; Devils River, Valverde County.

In similar situations to last, but less common and more restricted in range, apparently occurring only in the southwestern part of the state.

CHEILANTHES LEUCOPODA Link. Montell, Uvalde County, 12325, 13336; Chalk Bluff, Uvalde County.

Found only on high limestone hills, on exposed slopes and ledges.

CHEILANTHES FEEI Moore. Leakey, Real County, 10141; San Angelo, Tom Green County, 11140, 11144; Bronte, Coke County, 11169; Menard, Menard County, 11857; Gamble's Ranch, Armstrong County, 13930;

Colorado, Mitchell County, 13777; Strawn, Palopinto County, 14239; Big Spring, Howard County; Sweetwater, Nolan County.

At San Angelo, Bronte, Colorado and Gamble's Ranch this species was found on sandstone bluffs, although at the last named station it was more abundant on Cretaceous limestone rocks. All other occurrences noted were on dry limestone bluffs, which is its usual habitat.

WEBB CITY, MO.

(To be continued)

The Botrychiums of Mobile County, Alabama

E. W. GRAVES

Mobile county lies principally in the coast plain. However, there is a line of sand hills extending down through the northwest corner of the county, running about half way across and coming within seven miles of the city of Mobile. The east side is very low and marshy. Along the Alabama river and Mobile bay, which bound the east side of the county, is a continuation of swamps which also cover a large part of the south end of the county.

The flora of this low country is very rich, for here we find *Sarracenia flava*, *S. rubra*, *S. psittacina*, *S. drummondii*, the yellow, red, and purple pitcher-plants. Also we find *Pogonia ophioglossoides*, *P. divaricata*, *Limodorum tuberosum*, *L. parviflorum*, *L. pallidum*, and *L. multiflorum*, and a large representation of Habenaria and others of the orchid family. Here too are found eight species of the Rhexia or Meadow Beauty family.

Among the ferns there are found the Woodwardias, Osmundas, *Dryopteris patens*, and other of the marsh loving kinds.

It is on the higher ground of the north and west part of the county that we find the subjects of this sketch.

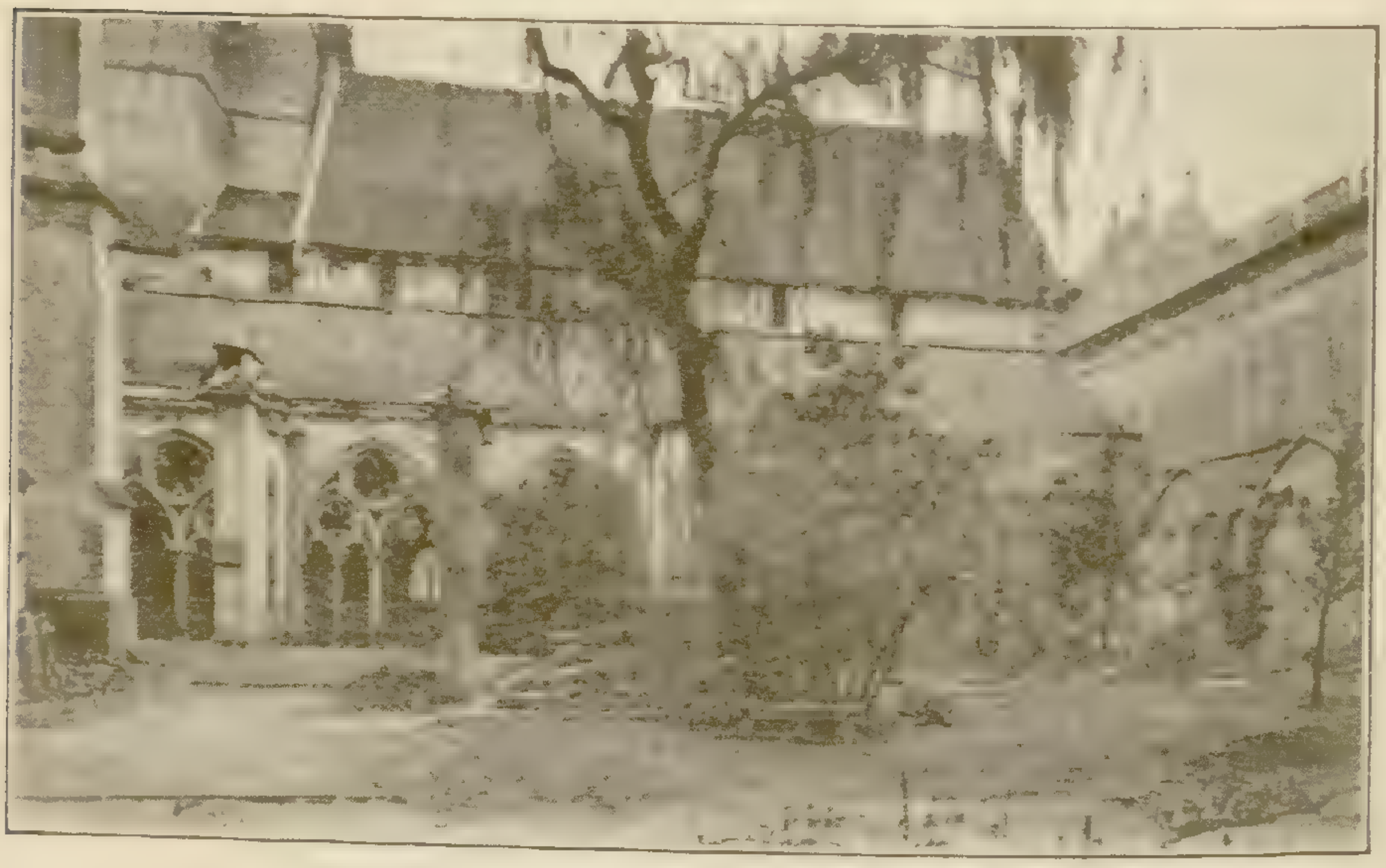
Botrychium biternatum (Lam.) Underw., which is found from North Carolina to Florida and westward into Alabama (as given by Mohr in his Plant Life of Alabama), is found only in Mobile county. *Botrychium Alabamense* Maxon, which was separated from *B. biternatum* a few years ago and given specific rank by Maxon, is found growing with *B. biternatum* and *B. obliquum* on the high land ten miles west of Mobile near the village of Spring Hill. *B. Alabamense* is the more common of the two. It is found commonly around Spring Hill and four or five miles to the west. To the north, near the town of Whistler, I found several plants growing. *B. biternatum* is quite rare in the county, growing only on Spring Hill in two small colonies. There are two distinguishing characteristics which show the wisdom of separating the two species. They are the character of the growth, and the time of fruiting. In growing, *B. Alabamense* lifts the sterile frond from three to ten inches above the ground, while in all the several dozens of specimens of *B. biternatum* I have seen, I have never found one that held the sterile frond more than an inch above the ground. Usually it lies spread out flat on the earth. The time of fruiting differs by several months. *B. Alabamense* is seen coming through the ground about the middle of July, and by the middle of September it begins fruiting. which is usually complete by the 15th of October. By the last of August *B. biternatum* is pushing through the ground, and by December the sterile frond is fully developed. But it is the first of January before the fertile frond begins to show itself through the ground. By the first of March it is in full fruit. By this time the fertile fronds of *B. Alabamense* have withered and the sterile fronds are turning red and begining to die down.

In size *B. Alabamense* is the larger, reaching a height of fifteen to eighteen inches. *B. biternatum* runs from three to seven inches.

I have studied these ferns for about two years and this is the data that I have made from my study.

I have a few specimens and I am willing to divide with members of the society if stamps are sent to cover postage.

SPRING HILL, ALA.



MONASTERY GARDEN, NOYON (before the war)

A FERN FROM THE BATTLE-GROUND.—I have in my herbarium a fine specimen of *Dryopteris filix mas* Schott. The frond was taken from a plant in the fern garden of Mrs. Wm. F. Brooks, New Britain, Conn. The plant was taken from the Monastery garden of Noyon Cathedral, Noyon, France, by Mrs. Brooks in July, 1913. It seems to me that battle-scarred country would be poor collecting ground for the fern collector to-day.—H. C. BIGELOW, New Britain, Conn.

Recent Fern Literature

Elizabeth Dorothy Wuist Brown has described a case of presumably induced apogamy among prothallia of

the walking fern grown on a nutrient solution which was purposely not renewed for long periods, so that the prothallia were partially starved. Other investigators have concluded that, in cases observed by them, apogamy was induced by too much light and too little moisture for fertilization. Mrs. Brown, however, considers that in this instance it was due rather to insufficient nourishment. From the fact that only one case of apogamy could be obtained among many prothallia, she argues that under natural conditions this phenomenon is rare in the walking fern and not easily brought about.[1]

Vaughan MacCaughey has contributed to *Torreya* an account of the "pala" or mule's-foot fern (*Marattia Douglasii*,) now the only representative of its family in Hawaii, but perhaps the remnant of a once much more numerous marattiaceous flora. The species in question, abundant in the mountains, is a small tree-fern with a short trunk 1-2 ft. high and very large wide-spreading fronds. It is remarkable for the fleshy stipules at the base of the leaves, which remain adherent to the trunk and living even after the leaf has fallen. They are starchy and mucilaginous, were used as an article of food by the primitive Hawaiians and are said to be highly palatable when baked. "Mule's foot fern" is Mr. MacCaughey's own suggestion for an English name for this fern. Its appropriateness lies in the fact that the "enlarged leaf-base with the two thick, fleshy stipules curiously resembles in shape and size" the hoof of a mule.[2]

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[1] Brown, Elizabeth Dorothy Wuist. Apogamy in *Camptosorus rhizophyllus*. **Bull. Torr. Bot. Club 46: 27-30, *pl. 2*. Jan., 1919.**

[2] MacCaughey, Vaughan. The pala or mule's-foot fern (*Marattia Douglasii* (Presl) Baker) in the Hawaiian Archipelago. Torreya **19:** 1-8. Jan., 1919.

Amedée Joseph Hans, a member of the Society since 1901, died at Locust Valley, Long Island, November 30, 1918. Mr. Hans was born Feb. 7, 1844, at Urbés, Alsace. When he came of age, he entered the gardening profession, having been a pupil of Louis van Houte of Belgium, proprietor of the most famous horticultural establishment of that time. Later, he took a position with another celebrated horticulturalist, Louis Lemoine of Nancy. So it was with the very best of qualifications that he landed in this country. His first position was at Morningside Park in New York, then under construction. This being a very rocky hillside park, Mr. Hans was in charge largely of a special class of alpine plants, with large moss phlox effects which were much appreciated by the general public travelling up and down the elevated road. He planted also thousands of the best alpine plants about the rocks of Central Park. He had a special talent for bringing forth the beautiful effects of color of the early varieties of moss phlox, with *Arabis alpina* and *Lychnis alpina* for white. He had a special love for alpine plants and felt himself in his element among them.

Mr Hans left the New York Parks to take charge of the private estate of Mr. Lowell M. Palmer at Stamford, Conn., which, under Mr. Hans's care, became celebrated for its beautiful evergreens and for a collection of hardy ferns probably not exceeded in America. Here Mr. Hans felt himself in his glory for many years; and I have spent many a happy day with him on this beautiful place. Afterward, he was persuaded to take charge of a new estate at Locust Valley, Long Island, and here, also, he gathered a fine collection of plants and had the best fruit garden I have ever seen in this country. He remained here until near the beginning of the two or

three years' illness which ended in the death of this great silent lover of God's almighty nature, loved himself by all who had the good fortune to know him.—JOHN F. HUSS, Hartford, Conn.

Mr. Hans was a real lover of ferns. Soon after he went to Locust Valley, he wrote with grief of the fact that ferns would not do well in that dry, brookless section of Long Island. His fern beds at Stamford were full of what were individual plants to him, and he was continually adding species by purchase, and by sowings of spores received from abroad. He established the fact that the holly fern, *Cyrtomium falcatum*, if derived from a north of Japan source, was hardy with slight protection.

Of even greater interest were his experimental spore plantings. As a result of one of these he obtained sporelings of *Nephrolepis* from material of the commonly cultivated *N. exaltata bostoniensis* which is almost invariably sterile. He published a brief report of this culture in the Florists' Exchange. At the Stamford place, in the small greenhouse, besides a small collection of greenhouse ferns, he had a section for spore growing, and every planting was made an experiment in hybridization, two or more varieties being planted together. At least once he obtained very interesting results, in the form of a distinct hybrid between *Dryopteris filix-mas* and *D. marginalis*, reference to which was made in the Fern Journal in connection with Mr. Winslow's description of the wild type of this hybrid. A specimen was deposited at the N. Y. Botanical Garden.—R. C. B.

The death of Prof. George Francis Atkinson from influenza and pneumonia removes one of the most prominent botanists of the country. Prof. Atkinson had recently discontinued active work as professor of bot-

any at Cornell, where he had been Head of the Department since 1896, and had gone to the west coast of the U. S. to collect fungi, a group which had occupied his main attention for many years. Earlier in his career he had given considerable attention to the study of ferns and had contributed important researches on their morphology and physiology.

Dr. Benedict has generously presented to the Society a number of copies of reprints of articles by him, for distribution to the members. The articles are as follows:

Studies in the Ophioglossaceae—III: Key to Botrychium in North America: Group of *B. ternatum*. (Reprinted from Torreya, Oct., 1909.)

A peculiar Habitat for Camptosorus. (Reprinted from Torreya, Jan., 1910.)

Some modern Varieties of the Boston Fern at their Source. (Reprinted from Journ. N. Y. Bot. Gard., Sept., 1915.)

Some horticultural Fern Variations. (Reprinted from Amer. Fern Journ., March, 1916.)

Copies of any or all of these reprints may be obtained by members on application to the Secretary, accompanied by two cents for postage.

The editors earnestly hope that the older members will be moved to action by Mr. Winslow's example and accept his invitation to contribute to the JOURNAL reminiscences of the early days of the Society. We have already in hand something of this general character in the shape of a very interesting letter written some years ago by Raynal Dodge and describing in much more detail than anything hitherto published his work which led to the discovery of *Dryopteris simulata* and *D. cristata* × *marginalis*. Recollections of old times and the elder fern-lovers and fern-students, so many of whom have passed away, will be welcome for the JOURNAL.

In this number, a slight change in the arrangement of the JOURNAL is made. The supply of notes for the "Notes and News" department has greatly dwindled of late, and such news as comes in can very well be put with the Society matter. The heading "Notes and News" is, accordingly, discontinued; all original contributions, no matter how short (and we want short notes as much as ever, or more) are run as separate articles with, however, only a "side-head" for title if they occupy less than a page; reviews are placed by themselves under the heading "Recent Fern Literature;" and news items are put on the Society pages. If this arrangement proves satisfactory, it will be continued in future issues.

For the benefit especially of new members and beginners in the study of ferns, the editors wish again to call attention to the fact that they are ready and anxious to answer questions and give all help possible.

For the attractive illustration of the monastery garden at Noyon, the JOURNAL is indebted to Mrs. William F. Brooks, who very kindly furnished the plate.

Report of the Treasurer for 1918

RECEIPTS

Cash on hand, Jan. 1, 1918			$142.05
Membership dues for 1917	$19.00		
" " " 1918	191.40		
" " " 1919	13.20		
" " " 1920	1.00		
		$224.60	
Subscriptions for 1917	$ 2.80		
" " 1918	33.08		
" " 1919	9.90		
		45.78	
Carried forward		$270.38	$142.05

Brought forward	$270.38	$142.05
Emergency Fund, sale of back numbers	10.80	
Interest	6.00	
Advertising	4.00	
Miscellaneous	.47	
Total receipts during the year		291.65
Grand total		$433.70

DISBURSEMENTS

Secretary's expenses, postage, election of officers, list of members, etc.	$ 19.84	
Treasurer's expenses: postage and printing	10.00	
JOURNAL expenses: Printing	$201.06	
Illustrating	14.85	
Editors' expenses	20.62	
	236.53	
Total disbursements		266.37
Balance on hand, Dec. 31, 1918		$167.33

This balance includes:

Emergency Fund now	$ 65.99
Illustrating Fund	5.75
Set aside for printing catalogue of the Herbarium	25.00
Regular Fund, available for regular use	70.59
	$167.33

The Special Fund created by the Life Memberships and transfers from the Emergency Fund from sale of back numbers now amounts to $100, not having been increased this past year.

COMPARISON OF BUDGET AND PAYMENTS

Item	*Allowance*	*Payment*
Secretary's expenses	$22.50	$19.84
Treasurer's expenses	10.00	10.00
JOURNAL expenses	232.00	236.53

Respectfully submitted,

J. G. UNDERWOOD, *Treasurer.*

Changes in the List of Members to Date

Names of new members added:

Arnold, William T., 21 Park Road, Wyomissing, Pa.
Bear, Mrs. Charles C., 142 Putman Ave., Detroit, Mich.
Beckwith, Miss Florence, 255 University Ave., Rochester, N. Y.
Butler, Mrs. Ellis Parker, 242 State St., Flushing N. Y.
Comstock, John Belden, New Britain, Conn.
Eames, Mrs. Edward A., 155 Bryant St., Buffalo, N. Y.
House, Dr. Homer Dolliver, Education Building, Albany, N. Y.
Jewell, C. J., Alstead, N. H.
Jurica, Hilary S., St. Procopius College, Lisle, Ind.
Lorenz, Miss Annie, 96 Garden St., Hartford, Conn.
Macy, Perry D., Smyrna, N. Y.
Poyser, W. A., 207 South 37th St., Philadelphia, Pa.
Rose, Milton Sawyer, 187 Fayerweather St., Cambridge, Mass.
Wherry, Edgar T., Bureau of Chemistry, U. S. Dept. of Agriculture, Washington, D. C.
White, Kelton E., 4354 Maryland Ave., St. Louis, Mo.
Ziegler, S. W., R. D. No. 4, Dover, Pa.

Changes of address:

Anderson, Miss Flora C., R. D. 5, Crawfordville, Ind.
Bates, Miss Ethel, Box 39, South Berwick, Maine.
Blake, S. F., Bureau of Plant Industry, U. S. Dept. of Agriculture, Washington D. C.
Cornman, Mrs. L. R., Hot Lake Sanatorium, Hot Lake, Oregon.
Durand, Dr. E. J., Pillsbury Hall, Univ. of Minnesota, Minneapolis, Minn.
Evans, J., Box 97, Kirkland, Wash.
Heatley, Miss Margaret, Huguenot University College, Wellington, C. P., South Africa
Killip, E. P., 108 East 4th St., Oswego, N. Y.
Newman, Rev. S. M., R. D. No.5, Danbury, Conn.
Phelps, Mrs. Orra P., R. D. 3, Gansevoort, N. Y.
Prince, Prof. S. Fred, Kansas State Agricultural College, Manhattan, Kan.
Scott, Mrs. Willard, 10 Park St., Brookline, Mass.
Stupp, F. J., 1 Sherman St., Auburn, N. Y.
Tuttle, Mrs. J. B., 1713 I St., Washington, D. C.

Names dropped:

A. L. Brandegee, Mrs. James E. Cooper,* C. K. Dodge,* Raynal Dodge, G. L. Fisher,* Amedée Hans, Mrs. W. B. Jolley, Miss H. E. Jones, Dr. E. I. Keffer, W. H. Leibelsperger, Miss Daisy J. Levy, Rev. H. G. Limrie, Mrs. Charles P. Mervin, J. H. Pember, Prof. Ida L. Reveley, John W. Roberts,* Miss S. F. Sanborn, Mrs. M. W. Satchwell, Miss Blanche Turner,* Miss M. L. Utley.

Mr. Leston A. Wheeler has become a life member.

President Maxon has appointed the following committee to nominate officers for the year 1920: Mr. C. H. Bissell, Chairman, Southington, Conn.; Miss Nellie Mirick; and Dr. Philip Dowell. All interested are reminded that nominations made in writing by any three members in good standing and sent to the Chairman before August 20, will be placed on the official ballot.

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* Deceased.

American Fern Journal

Vol. 9 JULY–SEPTEMBER, 1919 No. 3.

Notes on American Ferns—XIV.[1]

WILLIAM R. MAXON

DICRANOPTERIS FLEXUOSA (SCHRAD.) UNDERW.—The occurence of this species, the only known representative of the family Gleicheniaceae in the United States, near Delschamps Station in the Mobile Bay region of Alabama, was first reported in 1914,[2] the specimens having been collected the previous year by Mr. L. H. McNeill. As the plant was not subsequently reported from other parts of the near-by territory, in spite of painstaking search, this single station was visited repeatedly by local botanists, in particular by Mr. H. P. Löding and Mr. T. S. van Aller, of Mobile, who were interested in seeing that the fern at least maintained itself here. Mr. Arthur Howell's visit to the locality, also, has been mentioned in the JOURNAL.[3] News of the destruction of this locality, recently received, is confirmed by Mr. Löding and Mr. van Aller. It will be recalled that the fern grew in a small depression in a clay railroad cut. Early in 1918, Mr. van Aller writes, the railroad company removed all the clay bank in that vicinity for filling around a railroad bridge over the "narrows," literally wiping the fern out of existence. At least no trace of it has been found on several later visits, and unless some of the small plants which Mr. van Aller had transplanted

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[Vol. 9, No. 2 of the Journal, pages 33–66. Plate 3. was issued July 5. 1919.]

[1] Published by permission of the Secretary of the Smithsonian Institution.

[2] Amer. Fern Journ. 4: 15–17.

[3] 7: 105, 106. 1917.

to different places near by should thrive and perpetuate themselves, the species will unfortunately have disappeared from our United States flora. It was believed by Mr. McNeill that the fern grew naturally where discovered and this opinion is shared by all who are fortunate enough to have visited the locality.

ATHYRIUM AMERICANUM (BUTTERS) MAXON.—By an unfortunate clerical error the locality data for the recent Nevada record[4] of this species were stated wrongly. The record should stand as follows: Head of Caudle Creek, Pole Creek Ranger District, Humboldt Forest, Elko County, Nevada, alt. 2400–2550 meters, Aug. 18, 1917, *W. W. Eggleston 14135.*

WOODWARDIA CHAMISSOI BRACK.—For nearly twenty years the American material previously included in *Woodwardia radicans* has very generally and properly been regarded as specifically distinct from that exclusively Old World plant. It has been assumed, however, that the plants ranging from the region of Puget Sound to eastern Guatemala represent but a single species, *W. spinulosa* Mart. & Gal. Recent study shows, nevertheless, that the United States and British Columbia specimens differ consistently from the plant of Mexico and Guatemala; and while the distinguishing characters are variable, and to a certain extent comparative, they seem important enough to justify the recognition of two closely related species in the North American area. The name *Woodwardia spinulosa*, based upon Mexican material,[5] applies to the southern form; the northern species, which is especially common in the coast ranges of California, was well characterized long ago on California specimens as *W. Chamissoi*, by Brackenridge.[6] The main points of distinction are as follows:

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[4] Amer. Fern Journ. **8**: 121. 1918.
[5] Nouv. Mém. Acad. Sci. Brux. **15**[5]: 64. 1842.
[6] In Wilkes, U. S. Explor. Exped. **16**: 138. 1854.

W. Chamissoi

Fronds stiffly ascending from an oblique or erect rhizome, the stipes short and stout (up to 1.5 cm. in diameter).

Blades oblanceolate to linear-oblong or oblong-ovate, narrowed downward, the distant basal pinnae often only half as long as the middle ones.

Pinnae (the basal ones excepted) close, often imbricate, rigidly ascending, numerous.

Under side of segments nearly naked, except at an early stage; veins bearing numerous large, pale yellow, transparent resin glands.

Veins arising from fertile costal areoles oblique, once or twice forked, the branches mostly free (at least in upper half of segments).

Indusia nearly homogeneous (the outer part not abruptly membranous, at least), glabrous, often resinous-glandular at the base.

W. spinulosa

Fronds laxly ascending from a short-creeping or decumbent rhizome, the stipes long and relatively slender.

Blades broadly ovate, not narrowed downward, the basal pinnae large, nearly or quite as long as the middle ones, never distant and reduced.

Pinnae adjacent or all slightly apart, spreading or laxly ascending, few.

Under side of segments brownish-fibrillose along the veins, the minute scales filiform or filamentous, persistent; large resin glands wanting.

Veins from costal areoles less oblique, a majority of them joined basally to form one or sometimes two incomplete additional rows of areoles.

Indusia abruptly membranous in the outer part, never resinous-glandular, a few minute capitate hairs often borne upon the margin.

NOTHOLAENA DEALBATA (Pursh) Kunze.—This species, described by Pursh[7] as *Cheilanthes dealbata* upon specimens from the "banks of the Missouri," was transferred to Notholaena by Kunze in 1848,[8] who properly regarded his own *Notholaena pulchella*, founded on Missouri material a few years earlier,[9] as the same, and commented upon *N. dealbata* as "nearly related to *N. nivea*, though essentially distinct." Subsequently, true *N. dealbata* was found to extend from Missouri and Nebraska southward to central Texas; but there were

[7] Fl. Amer. Sept. 2: 671. 1814.
[8] Amer. Journ. Sci. II. 6: 82. 1848.
[9] Bot. Zeit. 1: 633. 1843.

also referred to this species certain specimens from New Mexico and Arizona which are not the same. A part of these were eventually recognized as being different; but on the basis of some of the others, which were regarded as connecting links with the typical form, *N. dealbata* was reduced to varietal rank under *N. nivea*, in 1883, by Davenport,[10] who quoted Baker to the effect that "*dealbata* seems to me now to run gradually into *nivea*." Underwood restored *N. dealbata* to specific rank in 1900,[11] but nominally only and without drawing any clear distinctions, as may be inferred also from his recognizing both *N. nivea* and *N. dealbata* as occurring in New Mexico and Arizona. The facts are, however, that *N. dealbata* is a fairly well-marked species confined apparently to Nebraska, Kansas, Missouri, Arkansas, Oklahoma, and that part of Texas lying from the central portion of the State northward; and that the plant of New Mexico, Arizona, and southern Utah, which has been rather vaguely understood as *N. nivea*, is specifically distinct alike from *N. dealbata* and true tropical American *N. nivea*. The distinctive characters of *N. dealbata* are mentioned hereafter in comparison with the Mexican Border plant, which may appropriately be known as:

Notholaena limitanea Maxon, sp. nov.—Rhizome decumbent or horizontal, woody, relatively large, 1–4 cm. long, 1–1.5 cm. thick, conspicuously chaffy at the apex; scales loosely tufted, light castaneous, linear-attenuate, 7–10 mm. long, about 0.5 mm. wide, lightly flexuous, subentire, with a few stalked, turgid, marginal glands. Fronds numerous, cespitose, erect or ascending, 8–25 cm. long; stipes 4–12 cm. long, very dark castaneous or atropurpureous, usually rather slender, naked above the curved base, glaucous; blades deltoid-

[10] Cat. Davenp. Herb. Suppl. 44.
[11] Nat. Ferns, ed. 6, 88.

ovate, subpentagonal, acute, 5–15 cm. long, 4–11 cm. broad, 4–5-pinnate, the rachises blackish, delicate, the minor ones almost capillary; pinnae about 6 pairs, slightly ascending, subopposite, long-stalked, deltoid, contiguous; basal pinnae much the largest, about half as long as the blade, conspicuously long-stalked, subternate, with the basal pinnules long-stalked, subternate, deltoid, the other pinnules smaller, less decompound, and with shorter stalks; ultimate segments sessile or nearly so, mostly 2–3 mm. long, linear-oblong, appearing slightly broadest at the obliquely truncate or subcordate, inequilateral base, or at maturity often broadly oblong or bluntly ovate-oblong by the thrusting back of the widely revolute margin, the segments thus often plane; under surfaces thickly but flocculently whitish-ceraceous; sporangia numerous, extending at least half the length of the veinlets from their tip, only partially concealed at any stage. Leaf tissue spongiose-herbaceous, glaucous above.

Type in the U. S. National Herbarium, No. 736532, collected on Tortugas Mountain, southeast of Las Cruces, Dona Ana County, New Mexico, altitude about 1,400 meters, Sept. 14, 1902, by E. O. Wooton. Tortugas Mountain, sometimes called also Little Mountain, is an isolated limestone mass rising rather abruptly from the mesa which lies west of the Organ Mountains toward the Rio Grande. The following additional specimens are in the National Herbarium:

NEW MEXICO: Tortugas Mountain, Oct. 14, 1893, *Wooton;* July, 1906, *Wooton & Standley;* Aug. 12, 1906, *Wooton & Standley.* Mogollon Mountains, alt. 2,400 meters, *Metcalfe* 1003.

ARIZONA: Hand's Trail, Chiricahua Mountains, alt. 2,100 meters, *Blumer* 1526. Dragoon Mountains, *G. R. Vasey* 6. Nogales, *W. Palmer* 1206; *Evermann.* Near Portal, Cochise County, in the Chiricahua National

Forest, alt. 1,600-1,800 meters, *Eggleston* 10983. Huachuca Mountains, August to October, 1882, *Lemmon; Holzner* (Internat. Bound. Comm. 1718). Sonoita Valley, *Rothrock* 657. Dutch Charley's Ranch, near Monument 88, Pima County, *Mearns* (Internat. Bound. Comm. 1851). Tombstone mines, Cochise County, Apr. 23, 1880, *Lemmon*.

UTAH: Mesa, between Bear's Ears, Elk Mountains, and the Natural Bridges of White Canyon, alt. 2,000-2,200 meters, *Rydberg & Garrett* 9386.

The specimens just cited agree in essential characters, but vary considerably in size, however, from Holzner's large Huachuca specimen to plants which, though by no means depauperate, are but half that size. In all these the broadly deltoid-ovate form of the blades is a constant and conspicuous character, the basal pinnae averaging at least half as long as the blade itself. Differing from them in minor particulars is the following form, which seems to merit recognition:

Notholaena limitanea mexicana Maxon, subsp. nov.—Blades narrower than in the typical form, oblong to oblong-lanceolate, 3-4-pinnate; pinnae more oblique, narrower, the basal ones only one-fourth to one-third as long as the blade; segments averaging larger.

Type in the U. S. National Herbarium, No. 42059, collected from limestone ledges of the Santa Eulalia Mountains, Chihuahua, Mexico, Sept. 15, 1885, by C. G. Pringle (No. 451). Agreeing with this are two sheets collected by Wilkinson at the same time and place, and a single Arizona specimen (Wilgus Ranch, Chiricahua Mountains, alt. 1,800 meters, Aug. 31, 1907, *Blumer* 2390). The appearance of these specimens is rather distinctive, but the characters are only comparative and the transition to typical *N. limitanea*, though not complete, is definitely indicated. Plants collected in the Burro Mountains of New Mexico by

Rusby in October, 1880, are also to be referred here.

Notholaena limitanea and *N. limitanea mexicana* are in all respects more robust than *N. dealbata*. That species differs particularly in its lesser size, its smaller rhizomes and smaller, often obtusely denticulate scales, its more slender (often capillary), paler stipes, its fewer pinnae, its narrow and much thinner segments (these for the most part with a narrowly cuneate base), its much more oblique veins (often apparent above), and in its very much fewer sporangia, these borne usually in a single row apart from the margin, commonly only one to an individual vein-branch.

The relationship of *N. limitanea* and its subspecies with the variable complex of Mexican and South American plants called *N. nivea* is about equally close. That collective species is distinguished in general, however, by its much greater size, its 2–3-pinnate blades, and its much larger, distinctly stalked, mostly cordate segments, as well as by characters of soriation and rhizome scales.

WASHINGTON, D. C.

Aspidium cristatum×marginale and A. simulatum

RAYNAL DODGE

[The following extracts from a letter written to Mr. C. H. Knowlton by Mr. Dodge in 1907 give a more detailed account of his discovery of the Massachusetts fern and the hybrid between the crested and marginal ferns than has yet appeared and should be of interest to our readers.]

Since boyhood I have been interested in nature study and in making collections of natural objects. My first interest was in birds, bird-egging and gunning, then in

entomology and mineralogy and to some extent in botany, but it was not until about thirty years ago, 1876, that I began to pay especial attention to botany.

I commenced with Gray's "How Plants grow" and various books on floriculture. I then bought Wood's "Class Book," which I gave considerable study. About 1879 I renewed my aquaintance with Mr. Edward Moulton in whose company I had made many expeditions in quest of birds and microscopic material in years gone by. He had been absent from the city for some years, as I had myself.

I found that he had been giving some attention to wild plants and so together we began to make botanical excursions into the surrounding towns and continued to do so for six or eight years or until he again removed from Newburyport. Our expeditions were made usually on Sunday and we sought wild plants with a good deal of persistency. I remember that one season we made botanical excursions on twenty-seven consecutive Sundays, collecting and examining plants, both phaenogams and cryptogams, and as we used the fourth edition of the Manual, both musci and hepaticae were included.

In the mean time we became acquainted with Mr. Alvah A. Eaton of Seabrook, N. H., who was also interested in botanical matters and who introduced us to many fruitful localities in Salisbury, Seabrook and Hampton.

During all this period from 1876 to 1892 and indeed up to the present time I was making a collection of pressed specimens of every plant I considered rare and have the collection yet. Many of these pressed specimens are fern fronds. I did not know the native ferns as well twenty-five years ago as I do now, but I was able to identify all the commoner species and especially I was able to distinguish between [*Aspidium*] *Thelypteris* and [*A.*] *Noveboracense.*

In due course of time Mr. Eaton went to California and Mr. Moulton to West Newbury and for a while I pursued my investigations alone. I soon, however, became acquainted with Dr. William Noyes, a former dental surgeon of Newburyport. I found that Mr. Noyes had for several years been interested in collecting and cultivating ferns. . . . I made many botanical trips with him, sometimes going fifteen or twenty miles from Newburyport and on one eecasion we made an excursion to Mt. Toby. . . .

One Sunday in August, 1891, accompanied by my nephew, I made a trip to the town of Merrimac, visiting a locality where I had been once before, one of my objects being to obtain specimens of *Asplenium thelypteroides*. In lookimg over the ferns of the locality, of which there were quite a number of species, I came across a clump of what at first I took to be an odd looking form of A. *cristatum*. A. *marginale* was abundant on the hillside and A. *cristatum* equally so in the low land between the hill and a neighboring river and I could but notice that this fern new to me grew at the very foot of the hill. I made further search and about fifty yards further on found another clump in the same position—that is, at the foot of the hill. A long-continued quest for the fern both on the hillside and in the low land proved to be fruitless.

I collected specimens and returning home looked up A. *cristatum*, var. *Clintonianum* in the Manual and later in Eaton's "Ferns of North America" (Boston Public Library), but I rejected the idea that it was a variety of A. *cristatum*, having already made up my mind that the new fern was a mix between A. *cristatum* and A. *marginale*. . . . .

I contimued my investigations into the new fern. I made a good many botanical excursions the next summer, always having in mind the question of the relative abun-

dance of the fern. I found that, given the proper conditions, a hillside with *marginale* and a swamp with *cristatum*, the new fern, the hybrid, was nearly always to be found at the dividing line. On these excursions I was often alone, but sometimes accompanied by my nephew or by Dr. Noyes. I found the hybrid in Amesbury, Newbury, Topsfield, West Newbury and growing abundantly at Crooked Pond in Boxford.

I got together my notes and in the summer of 1892, made up a package of specimens and sent both notes and specimens to Prof. Eaton of Yale. . . . . [He] coincided . . . . with my views as regards the fern being a hybrid and advised me to publish an account of it. I answered that I preferred to have him do so. Prof. Eaton then sent the package to Mr. Davenport, from whom I a little later received a letter to that effect. I then invited Mr. Davenport to meet me at Topsfield depot, there to take conveyance to Crooked Pond in Boxford. . . .

On arriving at Crooked Pond I showed the fern to Mr. Davenport, growing in as many as a dozen places. In fact, Crooked Pond is, or was, an ideal place for *Aspidium cristatum* × *marginale*. I made it clear to Mr. Davenport that the fern in question grew nearly always at the foot of the rocky hills next the marsh. I showed him that in several instances a large fern occupied the central position with younger ferns clustered about it, and that these smaller ferns had originated from radiating rootstocks, that the fronds resembled those of *marginale* at the tip and those of *cristatum* below, and that the plants had a remarkable tendency to produce misshapen and abortive fronds. I then left the case with Mr. Davenport who lifted some of the ferns to, as he said, cultivate and study them on his grounds at Medford.

In this connection, see Botanical Gazette, Dec. 1894, and Garden and Forest, Vol. IX, No. 454, wherein are

contained articles by Mr. Davenport relating to this fern. It is the same which for years has been known as *A. cristatum*, var. *Clintonianum* which, however, does not grow in eastern Massachusetts. But, nevertheless, our fern, until I showed that it was a probable hybrid, had always been known as var. *Clintonianum*. Several specimens in the herbarium of the Peabody Academy of Sciences are tagged in this way, one or two of them are among the specimens of *A. cristatum*, and it is fair to presume that in the herbarium at Cambridge there are some fronds of this hybrid marked *cristatum Clintonianum.*

But var. *Clintonianum* is as much a product of calcareous soil as are *A. Goldieanum* or *Cystopteris bulbifera.* I have had a half dozen plants of Clintonianum under cultivation, some from western Massachusetts, and some from New York. One of these plants was sent me by an attorney of Buffalo after an examination of Judge Clinton's specimens in the herbarium of the Buffalo Academy of Sciences. I received this fern with the understanding that it was taken from the identical swamp where Judge Clinton collected his plants. These plants of *A. cris*[*tatum*] *Clin*[*tonianum*] are unlike the plants of *A. cris*[*tatum*] × *marg*[*inale*] although the books have made no distinction between them. The idea I have regarding the fern which has been named var. *Clintonianum* and especially regarding Judge Clinton's plant is that it is a hybrid between *Aspidium Goldieanum* and *Aspidium cristatum*. They have every appearance of this and I think the subject should be investigated.

Aspidium simulatum

In August, 1891, Mr. William H. Swasey of Newburyport showed me a peculiarly shaped frond which he had taken from a fern growing at the "Pines," so called, at Newburyport. This frond had somewhat the appear-

ance of one from a plant of *Aspidium Noreboracense*. Its lower pinnae, however, were more like those of *A. Thelypteris*, but broader, ovate, acuminate and inflexed. The venation was that of *Nore*[*boracense*].

At his invitation, I accompanied him to the locality. We found but few ferns having fronds of this peculiar character and these not well grown, compared with many which I afterward found. A few days later, Mr. Swasey made another trip in quest of the fern, this time going to Salisbury. He returned with some finely grown fronds which he brought to me for examination. These fronds had the same general characteristics as those he got at the "Pines," but all more intensified, so to speak.

We discussed the fern on several occasions and I remember particularly that I once asked Mr. Swasey whether he thought the fern most like *Thelypteris* or *Nore* (as we used to term it.) He answered that he thought it most like *Nore* despite the general outline of its fronds. He said that he considered it to be a variety of *Nore* and I at the time coincided with his opinion.

You will understand from Mr. Davenport's article in Garden and Forest Vol. IX, that terming this fern a variety of *Noreboracense* was a long step in advance. Mr. Davenport in the article referred to gives several instances where the fern had already been collected and referred to *A. Thelypteris*, once indeed by himself. Prof. Eaton also gave me the impression that he considered the fern to be a form of *Thelypteris*. . . .

I became much interested in the case, and began making excursions into the surrounding country in search of the fern. I found it in some cases growing by the acre, sometimes to the exclusion of any other species. I found too that when growing in localities where the trees had been cut away, thus exposing it to the direct rays of the sun, the fern took on the exact appearance of the narrow form of *Asplenium Filix-foemina* with condup-

licate pinnae, which *Thelypteris* and *Noveboracense* never do. I found also that small plants of this fern were almost identical in appearance with those of *A. Filix-foemina*. I communicated these facts to Mr. Davenport later on and it was the resemblance of the fern in certain stages to lady fern that caused him to name the plant *A. simulatum*.

I then remembered that I had seen what at the time I considered to be an immense amount of this narrow contracted form of lady fern growing years before at Folly Mill Woods in Seabrook, N. H., and had collected specimens. I made a trip to the place to look the matter up. I found that in my old locality for the supposed lady fern there was to be found an abundance of the new Aspidium and very little of the Asplenium, the ground having become shaded by a growth of young trees, but in the immediate neighborhood I found a place where the trees had been cut away recently and there the new fern with conduplicate pinnae was abundant.

I looked up my specimens and in doing so I also found that I had collected some fronds of the new fern which had grown under normal conditions as forms of *Aspidium Noveboracense*. These fronds were collected about 1880. My second visit to the locality about which I have been writing was made in August, 1892. . . .

When I sent the package of hybrid fronds and notes on the hybrid fern to Prof. Eaton in the autumn of 1892, I included in the bundle fronds of this fern which Mr. Davenport has termed *Aspidium simulatum* and also gave Prof. Eaton the results of my observations on it. Prof. Eaton requested me to send him plants of the fern for cultivating and I did so.

When I made the appointment to meet Mr. Davenport at Crooked Pond in Boxford, I placed some freshly gathered fronds of *simulatum* in my vasculum. After we had examined the hybrid plants at the foot of the

hills to the satisfaction of Mr. Davenport, and had taken a seat in the shade for awhile, I . . . . brought out my fronds of *simulatum* and asked him whether he considered they were fronds of *Thelypteris* or *Nove*. He replied that he considered they were fronds of neither. I then gave him a short account of my observations on the fern, telling him it was very abundant in some localities, remarking that the differences between the fern and *Thelypteris* and *Nove* were evidently not produced by environment, as without searching particularly I had noticed several places where a person without changing position could lay hands on a clump of each fern. Mr. Davenport became interested and we made arrangements for an excursion to the Small Pox woods in Salisbury a week from the following Sunday. Our trip to Crooked Pond was made on Saturday.

This is my story, or as much of it as has not appeared in the botanical journals. See . . . Fern Bulletin, Vol. IV, no. 3, for an article by myself. . . .

Anyone previously unfamiliar with this fern and who yet could easily distinguish between *Thelypteris* and *Nove* would, at the first sight of a growing clump, conclude that the fern was *Nove* with a peculiar habit of growth. Further examination, however, shows that the fronds at the base are more like those of *Thelypteris* but with inflexed pinnae of a differing shape. When pressed these fronds become still more like those of *Thelypteris* in appearance and so are very deceiving. To be sure, the venation is not that of *Thelypteris*, but as some fronds of *Thelypteris* have pinnae with quite simple veins, the experts let this difference pass by. Many little details of differences between the three ferns I communicated to Mr. Davenport and it was Mr. Davenport, be it remembered, that gave the final decision that the odd form was a new fern to be called *Aspidium simulatum*.

NEWBURYPORT, MASS., *May 27, 1907*.

Texas Pteridophyta—III

ERNEST J. PALMER

CHEILANTHES TOMENTOSA Link. Granite Mountain, Burnet County, 10261; Milano, Milam County, 11689; San Saba, San Saba County, 11821; Brownwood, Brown County, 11908.

In clefts or ledges, usually of sandstone or silicious rocks. The specimens from Granite Mountain were growing in clefts of granite, where it is commonly found.

CHEILANTHES LINDHEIMERI Hook. Leakey, Real County, 10142; Uvalde, Uvalde County, 11047, 13503.

Found at Uvalde amongst trap-rock (phonolite) rubble, and at Leakey along dry limestone ledges of high hills.

NOTHOLAENA DEALBATA (Pursh) Kunze. Brownwood, Brown County, 10377, 11114; San Saba, San Saba County, 11805; Johnsville, Erath County, 14200; Strawn, Palopinto County, 14238; San Marcos, Hays County.

In clefts of dry limestone cliffs and boulders, with partial shade. Most abundant in the Carboniferous area and appears to have extended thence into the edge of the Comanchean formations.

NOTHOLAENA CANDIDA (Mart. & Gal.) Hook. Leakey, Real County, 10145; Barksdale, Edwards County, 11011; Concan, Uvalde County, 11552; Montell, Uvalde County, 13001; Devils River, Valverde County; Junction, Kimble County; Chalk Bluff, Uvalde County.

Found on high limestone hills, growing on exposed slopes and ledges.

NOTHOLAENA SINUATA (Sw.) Kaulf. Leakey, Real County, 10143; Barksdale, Edwards County; Uvalde, Uvalde County, 11048; San Angelo, Tom Green County,

11139; Bronte, Coke County, 11168; Campbelton, Atascosa County, 11235; San Saba, San Saba County, 11791; Manchaca, Travis County, 12152; Colorado, Mitchell County, 13780; Montell, Uvalde County; Medina Lake, Bandera County; Devils River, Valverde County.

Amongst limestone rocks or along dry ledges throughout the Edwards Plateau. At Uvalde it was found amongst trap-rock (phonolite) rubble, and at Campbelton on dry Tertiary sandstone hillsides. In its northwestern range, as at Colorado, Bronte, and San Angelo, it is often found amongst sandstone rocks of the Permian or Triassic formations.

NOTHOLAENA GRAYI Davenp. Uvalde, Uvalde County, 13504.

This species appears to be very rare east of the Pecos River. It was found growing amongst rubble on the south side of a trap-rock (phonolite) hill, near Uvalde, where it is rather scarce.

ASPLENIUM PARVULUM Mart. & Gal. Lacey's Ranch, Kerr County, 9955; Kerrville, Kerr County, 11504a; Upper Seco Creek, Bandera County, 10240; Brownwood, Brown County, 11113; Manchaca, Travis County, 12141; Sabina Creek, Kendall County, 13636; San Marcos, Hayes County; Montell, Uvalde County; Boerne, Kendall County.

On limestone cliffs and ledges, in partial shade, but rather dry situations.

ASPLENIUM PLATYNEURON (L.) Oakes. Columbia, Brazoria County, 5062; Marshall, Harrison County, 5305; College Station, Brazos County, 9352; Dayton, Liberty County, 11463; Quarry, Washington County, 11706; San Augustine, San Augustine County; Houston, Harris County; Riverside, Walker County; Palestine, Anderson County; Larissa, Cherokee County.

Widely distributed in both the eastern and western parts of the state. Commonly grows amongst rocks on partially shaded hillsides, but where such conditions are not found it appears to be quite adaptable. At Columbia it was found on knolls and about stumps in low, wet woods, at College Station and San Augustine on banks in sandy woods, at Dayton on superficial roots of Magnolia trees and at Palestine on tree trunks, three or four decimetres above the ground.

ATHYRIUM FILIX-FOEMINA (L.) Roth. Marshall, Harrison County, 5307; Larissa, Cherokee County, 8626; Grapeland, Houston County, 12057; San Augustine, San Augustine County, 12714; Palestine, Anderson County; Fletcher, Hardin County.

In sandy bogs or moist, sandy woods, throughout the southern and eastern portions of the state.

WOODWARDIA VIRGINICA (L.) Sm. Grapeland, Houston County, 12059; San Augustine, San Augustine County, 12705.

Found in sandy bogs or low, sandy woods, but nowhere very abundant.

WOODWARDIA AREOLATA (L.) Moore. Marshall, Harrison County, 5310, 8607; Milano, Milam County, 11682; Huntsville, Walker County, 12053; San Augustine, San Augustine County, 12704; Grapeland, Houston County; Palestine, Anderson County; Fletcher, Hardin County.

Grows in similar situations to last, but is commoner and more widely distributed.

ONOCLEA SENSIBILIS L. Marshall, Harrison County, 5306; Larissa, Cherokee County, 8625; Palestine, Anderson County, 10729; Houston, Harris County, 11997; Huntsville, Walker County, 12052; San Augustine, San Augustine County; Grapeland, Houston County.

In swampy, open woods or sandy bogs, throughout the eastern part.

TECTARIA TRIFOLIATA (L.) Cav. Montell, Uvalde County, 12328.

This, one of the rarest of Texas ferns, was found growing near the entrance to a small, dry limestone cave. The opening is a narrow fissure in horizontal limestone strata on a level hilltop, and the plants were growing on a dry ledge below it, where they received direct sunlight only during a short time each day, and almost complete protection from the hot winds and scorching sun in summer and the extreme cold of winter. A specimen in the herbarium of the Missouri Botanical Garden, collected by Lindheimer in 1847, "At the entrance of a dry limestone cave," near New Braunfels, is the only other collection from Texas, so far as I am aware.

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott. Livingston, Polk County, 5160, 5253; Houston, Harris County, 11995; Huntsville, Walker County, 12055; Marshall, Harrison County; San Augustine, San Augustine County; Fletcher, Hardin County.

On rich wooded hillsides or steep, shaded banks of ravines.

DRYOPTERIS THELYPTERIS (L.) Gray. Liberty, Liberty County, 8554; Grapeland, Houston County, 13183.

In open, sandy bogs. Apparently rather rare and restricted.

DRYOPTERIS NORMALIS C. Chr. (*Aspidium patens* D. C. Eaton, not Swartz.) Columbia, Brazoria County, 5014; Brazoria, Brazoria County, 5111; Livingston, Polk County, 5167; San Augustine, San Augustine County, 7898; Marshall, Harrison County, 8646; Pledger, Matagorda County, 9699; Lacey's Ranch, Kerr County, 9979; Telegraph, Kimble County, 10940; Devils River, Valverde County, 11380; Dayton, Liberty County, 11464; Blanco, Blanco County, 11570;

Houston, Harris County, 11941; Montell, Uvalde County; Medina Lake, Bandera County; Manchaca, Travis County; San Marcos, Hays County; Boerne, Kendall County; Pulliam, Zavalla County.

In eastern Texas this species is found along the margins of sandy creeks and bayous, and is confined to the southern portion. I did not observe it north of San Augustine. In the Edwards Plateau it is confined to deep canyons, where it grows about the margins of pools or at the foot of dripping limestone bluffs or on wet ledges. Here it is nearly always associated with *Adiantum Capillus-Veneris*.

PHEGOPTERIS HEXAGONOPTERA (Michx.) Fée. San Augustine, San Augustine County, 14462.

Sandy, wooded bank, on margin of bog. This is the only station at which I have found the species in Texas and I am not aware that it has been previously reported from the state.

WOODSIA OBTUSA (Spreng.) Torr. Marshall, Harrison County, 5295; Longview, Gregg County, 7128; Bryan, Brazos County, 7809; Granite Mountain, Burnet County, 10260; Milano, Milam County, 11659; Quarry, Washington County, 11708; Huntsville, Walker County, 12036; Riverside, Walker County, 13160; Palestine, Anderson County, 12083; Manchaca, Travis County, 12140; Larissa, Cherokee County.

Amongst rocks or along rather dry shaded ledges. Most abundant in sandstone or granite regions.

WEBB CITY, MO.

A Crested Form of the Lady Fern

L. S. HOPKINS

In the summer of 1916, while on a field trip near Windham, Portage County, this state, I found a crested form of the Lady Fern. The form was new to me and sufficiently beautiful to make a rather striking appearance. I lifted the plant and brought it home. It was first given a place with several other ferns in a small bit of native woods on the college campus.

Although assurance had been given that the ferns were in no danger and would not be disturbed during the construction of a new dormitory nearby, the workmen buried the entire bed under logs, scrap lumber, and rubbish to the depth of some six or eight feet before their plight was discovered. After half a day of very strenuous labor on my part, which was a source of considerable amusement to those who had been guilty of the carelessness, the roots of perhaps half of the ferns, all of which were the very rarest species known to the state, were recovered and transferred to a hastily prepared fern-bed by the side of the house in which I am now living.

The crested Lady Fern was one of those which was rescued. It took kindly to its new home and has become more cristate each year until it is now a plant of real beauty.

Dr. Butters[1] has shown that there are two species of Lady Ferns instead of one in the eastern half of the United States, neither of which is identical with *Athyrium filix-foemina* (L.) Roth, of Europe. He concludes further that *Athyrium asplenioides* (Michx.) Desv. is prevailingly southern in its distribution, while *Athyrium angustum* (Willd.) Presl is prevailingly northern in its distribution.

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[1] Contributions from the Gray Herbarium of Harvard University. Butters, F. K. Rhodora **19**: 189–207, pl. 123. Sept., 1917.

Athyrium angustum, var. cristatum Hopkins

I am not aware to what extent, if any, crested forms of the Lady Fern are represented in the various herbaria and fern gardens. However, in the light of Dr. Butters' conclusion, it is improbable that this particular form has ever been given its proper name. I therefore wish to suggest that it be called

ATHYRIUM ANGUSTUM var. **cristatum** var. nov.

It is at once readily distinguished from the type and all other varieties by the crested pinnae and apex. The numerous (2 to 10) subdivisions of the pinnae are often again crested, giving the pinnae a plume-like appearance. The apex of many fronds bears such numerous crests that they are almost rosette-like in appearance. All of this is lost however in preparing specimens for the herbarium.

Fruiting fronds have been produced freely but the spores have not been tested to determine their fertility.

If by chance this form has been properly named elsewhere, the present notes will at least serve to call attention to what is likely to become known as the most beautiful form of this popular species.

Quite a number of herbarium specimens have been prepared and will be given to those who care to send postage.

STATE NORMAL COLLEGE, KENT, OHIO.

Commercial Fern Gathering

STEWART H. BURNHAM

Mr. Frank B. Tucker has published in *American Forestry*[1] an article on "Gathering the Spinulose Shield Fern," the picking of the fronds of which paid for his

[1] Am. Forestry 25: 1226–2128, illus. July, 1919.

vacation in Vermont several years ago. The name of the hamlet where he stopped is not given, but "it is delightfully situated in a dilation of a valley of a branch of the Deerfield River, some nineteen hundred feet above sea level, with encircling summits rising another ten hundred feet."

"About ten years ago, a shrewd-eyed native of the locality saw a fortune in the perennial crop of the spinulose shield fern" that grew in the moist woods abundantly, conceived the idea of marketing the fronds and now has become an acknowledged "benefactor of the community." Ordinarily, "picking begins about two weeks before Labor Day and lasts about five weeks." "During the height of the picking season some families earn as much as ninety dollars a week, clearing some five hundred dollars during the season." The men gather the ferns from early morning until late at night in large hampers which are brought in several times during the day to their women for bunching. The ferns are bound, in bunches of twenty-five, by a piece of thread, each bunch containing an assortment of sizes varying from about nine inches to eighteen inches. Some men bunch their ferns as they pick; however, most of the bunching is done by women or at night.

Some difficulty is experienced at the beginning, it is said, to distinguish the spinulose shield fern from other ferns growing with it, but a novice soon becomes proficient. An "expert gauges the size and quality of the ferns almost by the feeling of their stalks; and, instead of gathering them one at a time, his busy fingers take, in one operation, all those of the cluster that are of proper size. The ferns are not pulled up by the roots, but are broken off a few inches below the lowest frond." The dealer and his agents to whom the ferns are delivered ship these bunched ferns as far west as Chicago and Denver, and the wastage from being kept in cold

storage is often very great. It is stated that from this hamlet 90,000,000 fern fronds were picked in one year.

One's first thought, after reading this article, is that the spinulose shield fern, presumably *Dryopteris intermedia* (Muhl.) Gray, is doomed in the localities where it is so prodigiously picked. However, from what one can glean from the facts stated, the industry continues year after year with no apparent or appreciable exhaustion of the fern. This is without doubt due to the fact that the fronds are picked or broken off so that the rootstocks are uninjured, although one might suspect that yearly picking of the fronds would eventually weaken the vitality of the plants to a marked degree. Might not this be true with the half-evergreen spinulose shield fern?

Mr. W. N. Clute has copied[2] from the *American Botanist*, December, 1903, an article, "Destroying the Ferns." It relates largely to an attempt to pass a measure in the Massachusetts Legislature early in 1903, requiring that each commercial fern gatherer in the Berkshires and that State be required to have a license for fern picking, and to make other laws restricting the collecting. It is there stated, "not more than $50,000 worth of ferns are harvested in Berkshire every year," and "it is estimated that more than 100,000,000 ferns are gathered each year and put in cold storage at Springfield to be sent broadcast over the country." Undoubtedly this bill was killed in the Legislature, as a stiff fight was to be waged to defeat it. Prof. Clute ends the article by saying: "It is a mistake to think that removing the fronds, even in autumn, does no harm to the plants. Gathering the fronds late in the year injures the plants less than at other seasons, but it may be safely assumed that so long as the fronds are

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[2] Fern Bulletin 12: 55–57. April, 1904.

green the plant has use for them. . . . Any person willing to exterminate our ferns at $2.50 a wagon-load ought to be converted."

Mrs. Orra Parker Phelps writes[3] from Salisbury, Connecticut, of seeing large bales of ferns waiting for shipment at a little country station. "The ferns were *Aspidium marginale*, *A. spinulosum* and its varieties, and *Polystichum acrostichoides*. On none of the fronds did the spores seem to be ripe and some of the fronds were still so young that the tips were not fully developed." She asks, "How long does it take a fern to come from the spore to maturity? Surely no less than six years, probably much longer. But suppose the fronds were carefully collected, what of the scattering of spores for the production of new ferns?" Mrs. Phelps also speaks of the fact that "in the year 1869, the Connecticut legislature passed an act prohibiting the gathering of the climbing fern, *Lygodium palmatum*. Prior to that time, this beautiful fern had been extensively collected and sold for decorative purposes"; but since the passing of the act it has recovered from its threatened extinction in the regions where it grows.

Mr. Harold Goddard Rugg speaks[4] of the collecting of *Polystichum acrostichoides*, known to the collectors as the "dagger" fern, at Cavendish, Vermont, where "in one year three hundred and twenty-five thousand fronds were shipped to a Boston florist. This one florist, in the course of a year, uses one million fern fronds and one thousand pounds of ground pine or *Lycopodium* of various varieties." Mr. Rugg speaks of the collecting of *Dryopteris intermedia*, known as "fancy" or "lace" fern, in southern Vermont, where collectors have picked the fern in some localities for twenty-five

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[3] A Plea for Fern Protection. Am. Fern Journal 2: 22-23. Jan., 1912.

[4] Fern Protection Needed. Am. Fern Journal 3: 93-94. July-Sept., 1913.

years; and states that the pickers say "they can see no diminution in the quantity or even the quality of the plants." Mr. Rugg raises the question: "Does this collecting of fronds injure the plants themselves and in time kill them? As yet I have been unable to answer this question in a satisfactory way. It is true, doubtless, that careless pickers are apt to disturb the roots, which may become exposed to the dry surface air. In time this exposure may cause the death of the plant." It is further stated that ferns "are in more or less danger, from the many nurserymen who are now dealing in our hardy plants" and who "buy their plants directly from the collectors who despoil our woods of roots."

A reprinted newspaper clipping[5] states that "more than $30,000 has been paid out in the months of September, October and the first part of November to gatherers of wild ferns in the four Bennington County towns of Woodford, Stamford, Searsburg and Readsboro. The pickers were paid by the piece, four cents a hundred, and as there have been more than 6,000,000 ferns shipped out of the mountains this season, the sum total is easily reached." The hamlet Frank B. Tucker refers to is evidently one of these villages or in that vicinity. The clipping, as does Mr. Tucker in his article, speaks of lumber companies and individual property owners of "the mountain land on which the ferns are gathered" leasing "the picking privileges, instead of permitting free access to the property, as was formerly the case."

Mr. E. J. Winslow quotes[6] from an article by F. E. Robertson in *The Vermonter* for October, 1915, regarding the fern picking industry "in the towns of Woodford, Searsburg, Stamford and Readsboro," where "over

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[5] $30,000 Paid Fern Pickers. Am. Fern Journal 4: 28-29. Jan.–March, 1914.

[6] Carloads of Ferns. Am. Fern Journal 6: 19–20. Jan.–March, 1916.

50,000,000 ferns are gathered annually. These have a local value of something over $20,000. . . . A good picker will gather 10,000 to 12,000 ferns daily." It is stated: "Over 50 carloads of ferns have been sent this season from Bennington County to refrigerator headquarters in Pittsfield, Mass. Two carloads are sent from Bennington village each day." Mr. Winslow was not prepared to say whether the collecting of the fronds of ferns would seriously injure the plants, if it was done in the latter part of summer, and if proper care was used for separating the fronds from the crown; and asks that some Vermont reader in position to observe the methods and conditions under which this industry is being carried on report to the JOURNAL.

This review of the available evidence seems to show that the ferns which are used commercially are bearing up well under the strain of annual pickings. This is indeed encouraging, both from the point of view of the fern-lover and that of the industry. But it may be partly due to the abundance of the species in question and to the chance that the same plant may not lose all its fronds every year, even with pretty thorough picking. It is to be hoped that some one with the opportunity to do so will take kindly to Mr. Winslow's suggestion and make accurate observations of the real effect of commercial picking.

HUDSON FALLS, N. Y.

MONOMORPHISM IN EQUISETUM TELMATEIA EHRH.—This typically dimorphic species, which is the most abundant representative of the genus in Western Oregon, occasionally shows a tendency toward monomorphism, possibly indicating a reversion to a primitive type in which fertile spikes were borne on branching green stems. Ordinarily the pale-brown unbranched

fertile plants appear very early, and are followed some weeks later by the branching green sterile plants; but not infrequently along with the latter are found individuals with whorls of green branches, but bearing a fruiting cone at the apex. Three specimens of this sort were collected during a walk of less than a mile along the tracks of the Oregon Electric Railway between Orville and East Independence in Marion County, Oregon, on May 3 of the present year. All of them were growing in very dry gravel between the rails. On June 18, about a hundred similar plants were found in finely crushed rock ballast of the Southern Pacific tracks near Divide Station, Lane County—again, in a situation of unusual dryness. The typical form seems to prefer a low, moist habitat. This difference in habitat gives rise to the conjecture that the variation may be due to a deficiency of moisture and absence of shade.

A similar specimen sent the writer by Professor J. K. Henry from Vancouver, B. C., is determined by him as the variety *frondescens* A. Br. I have not seen the type-specimen, but it is a question whether such forms should be recognized as forming a true variety, or merely as teratological "sports" like four-leaved Trilliums. The cones seem to be normally developed, and the green branches fully as long as in the ordinary sterile plants.

A fourth specimen collected on May 3 shows a whorl of branches at each of the four lower nodes, a fully developed fruiting cone at the fifth node (about 18 cm. above the base) and a continuation of the stem with at least four more whorls *above* the cone.[1] All these specimens will be deposited in the herbarium of the Fern Society, and it would be interesting to know if this tendency to monomorphism has been observed by other collectors either in this country or in Europe.—J. C. NELSON, *Salem, Oregon.*

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[1] This specimen appears in the middle of the group of plants represented in **Plate 5.**

Branched fruiting stems of Equisetum Telmateia
Photograph by L. S. Hopkins of specimens collected by J. C. Nelson

American Fern Society

A short time before her death, Mrs. Judith H. Coffin, of Newburyport, Mass., donated to the American Fern Society, in memory of old friends of the Linnean Fern Chapter, Vols. 13 to 18 (from 1905 to 1910) of the *Fern Bulletin* and Vols. 1 to 7 (from 1911 to 1917) of the AMERICAN FERN JOURNAL. These magazines are given to the Fern Society either to keep or to sell, the proceeds to be added to the funds of the Society, or used in any way desirable. The American Fern Society is indeed very grateful for this kind and generous gift.

Mrs. Blanche Turner White, a member of the Society since 1916, died January 17, 1919—one of the many victims of last winter's epidemic of influenza. Mrs. White was descended from some of the early French settlers of St. Louis: one may imagine that their friendship with the wilderness had, in some degree, come down to her. She was a naturalist by nature—one who, it seemed, "as by instinct knew where, in far fields, the heather grew"—and she possessed the charming enthusiasm of her kind. Much of her brief life of thirty years was spent in the country about Arcadia, Missouri, where her desire to know about the rocks, plants and birds could be, and was abundantly, gratified. Eager to learn and to help others, she was much sought after. A member of several natural history societies, she was most actively connected with the work of the St. Louis Bird Club, serving that organization not only as officer, teacher and leader of excursions (especially of children), but in certain larger practical aspects of its work which touched on the planning of parks and residence districts and the teaching of the value of out-door life. She herself learned and put into her own life the best nature has to give.

Mrs. Judith Hopkins Coffin died at Newburyport, Massachusetts, July 22, 1919. She was born in November, 1831. Mrs. Coffin became a member of the Linnaean Fern Chapter early in 1896 and was much interested in the American Fern Society to the last of her life. She not long ago donated to the Society several volumes of the Fern Bulletin and of the American Fern Journal. She had collected and mounted specimens of the ferns and fern allies of Essex County, Massachusetts, and to the end of her life retained her mental faculties and interest in everything. She was a woman of rare graces of character and much could be said of the sweet simplicity of her life, of her kindliness and thoughtfulness for others, her courage and high ideals.

New Members—

Swain, Rev. James Ramsay, 4223 Osage Ave., Philadelphia, Pa.
Trudell, Harry W., 2030 East Madison St., Philadelphia, Pa.

Change of Address—

Heatley, Miss Margaret, University of South Africa, P. O. Box 1176, Johannesburg, South Africa.

The JOURNAL is indebted to the generosity of Professor L. S. Hopkins for Plate 4 in this number and also for the photograph from which Plate 5 was made.

By one of those typographical errors which form the subject of every editor's nightmares, the asterisk which should have gone with the name of Miss Blanche Turner in the additions and corrections to the list of members in the last number, was transferred to that of Miss Sarah F. Sanborn. The editor in charge of the proof-reading can only tender Miss Sanborn his most contrite apologies and wish her long life and happiness.—C. A. W.

With the issue of this number, the JOURNAL's copy-drawer is again nearly empty. We trust the members will continue to be on the look-out for matter of interest: the JOURNAL cannot be issued until we have the wherewithal to fill it.

The editors have received from one of our new members a query as to general works on ferns. He mentions Lyell's *Geographical Handbook of the Ferns*, and asks if there is anything better. We have answered this question by letter according to our ability, but we should like the help of the members in answering it and perhaps future questions of the kind more fully. We wish everyone who can would write to the JOURNAL (if possible, in time for the next number) telling what fern books each has found most interesting and helpful—not merely the general works directly asked about, but fern books of any character. If enough members contribute to it, the resultant list will have considerable value.

American Fern Journal

Vol. 9 OCTOBER–DECEMBER, 1919 No. 4.

Water and Mineral Content of an Epiphytic Fern.

ROLAND M. HARPER

Current botanical textbooks usually say little or nothing about the inorganic constituents of epiphytes, and tend to leave the impression in the student's mind that most of these plants derive their nutriment entirely from air and rain, and therefore consist wholly of gaseous elements and carbon (whose oxides are gases).* But every living organism contains protein, and every molecule of protein contains about 2% of phosphorus, none of whose compounds are vapors at ordinary temperatures, so that they are not found in the atmosphere. Furthermore, chlorophyll contains a small amount of iron, and the presence of potassium in small amounts is supposed to be necessary for the formation of starch, so that every green plant must contain some of these two metals, if not others.

[Vol. 9, No. 3 of the JOURNAL, pages 67–98, plates 4 and 5 was issued **Oct. 11, 1919.**]

*Existing knowledge about epiphytes is summarized very well in Schimper's Plant Geography (English edition, 1903), pp. 197–201, 317–329, and in Cowles's text-book of Ecology (1911), pp. 511–514, 614–616, 657–660.

The observations in this paper are intended to apply primarily to the epiphytes of temperate regions, most of which grow on the bark of trees and have no special organs for accumulating water or humus. In the tropics the epiphytic flora is much more diversified, including some plants that grow in large tufts adapted for catching falling leaves and other debris, some with concave leaf-bases that serve as reservoirs for rain-water and even as the homes of small animals, and some that grow in the axils of palm leaves, on smooth barkless trunks of palms and bamboos, or even on evergreen leaves; and some of the statements made herein would have to be modified to cover all such cases.

However, the source of supply of these non-volatile substances for epiphytes must be rather limited, and it is presumably for this reason that all epiphytes (so far as known to the writer) are evergreen. For it is obviously out of the question for an air-plant of any size to get enough solid "food" to make a complete new set of leaves every year, as most terrestrial herbs and all deciduous shrubs and trees do, and consequently such plants have leaves (or fronds or thalli in the case of some cryptogams) that last more than one year. Or the proposition might be reversed by saying that plants growing in fertile soils take up so much inorganic matter, which is deposited in leaves and other external parts by the process of transpiration, that they have to shed their leaves periodically to get rid of it.

It has been suggested that air-plants get some of their solid nutriment from dust, which is probably true; but in the heart of a vast trackless forest the quantity of dust that falls on any one herb in the course of a year must be quite infinitesimal, and there is no reason for believing that true epiphytes are less abundant in such places than near highways and habitations. Pollen of anemophilous trees is another possible source of food, just as available in a wilderness as elsewhere, but whether it contains iron and potassium or not the writer is not informed.

A much more likely source of inorganic matter for epiphytes of the type here discussed is the bark on which they grow. The bark of most trees contains 2 to 6% of mineral matter, and as it increases little in thickness with the growth of the tree it must be continually scaling off and decaying on the outside. One could with a little trouble make a rough estimate of the amount of mineral liberated in a year by a unit area of bark of a given species under normal conditions. The terrestrial herbs and deciduous shrubs that one

occasionally sees growing in the crotches of old trees must feed on bark detritus accumulated there, supplemented by a certain amount of dust, for such plants seem to be more frequent in and around settlements than far out in the woods. Falling leaves doubtless contribute a small quota too.

The most widely distributed vascular epiphyte in the United States is the little resurrection fern, *Polypodium polypodioides* (formerly known as *P. incanum*, and more recently as *Marginaria polypodioides*), which grows abundantly on living trees of various kinds from Virginia to Texas, mostly within 1000 feet of sea level. Like some other epiphytes, it is occasionally found also on non-calcareous rocks, not flat rocks on which water may stand and soil accumulate, but shaded cliffs and boulders (as in the case of its non-epiphytic northern relative, *P. vulgare*). There it has no connection with the soil (and is therefore inaccessible to earthworms, which seem to be detrimental to most evergreens), but probably gets all the nourishment it needs from decaying tree leaves that lodge around its roots. Another thing which its tree and rock habitats have in common is that they are rarely covered by snow or falling leaves; but whether that has any significance or not is not at present apparent.*

As everyone who has seen this fern alive knows, it responds readily to changes in atmospheric moisture. In dry weather the fronds shrivel up and look dead, but during and shortly after a rain, at any season of the year, they are fully expanded. The change from one condition to the other may take place in less than a day. Temperature seems to have little effect on it, except that the northern limit of the species may be determined by the minimum temperature, or the duration

* See Torreya 15: 30–31. 1915.

of freezing weather. It seems to withstand more cold than any other vascular epiphyte in North America, however.

Just how much water it can lose and still survive is not known, but it evidently contains less than most herbs, though perhaps not less than the average evergreen herb. In March, 1919, in moderately dry weather, I gathered 13 grams of the plant in its shriveled condition, and after soaking it in water over night, until the fronds were fully expanded, and then drying off the adhering water, it weighed 30 grams, or 2.3 times as much as in the dry condition.

The total water content and ash were determined in February, as follows. On Feb. 21, about 24 hours after a rain, I gathered about 340 grams of the fern from two or three species of oaks and one of elm in and near Tuscaloosa, Ala. The fronds were then fully expanded, and presumably free from dust, though not moist to the touch. The material was weighed about half an hour later, and then chopped up to kill it, and dried for about a week, much of the time on top of a steam radiator, where a thermometer inserted in the bag of fern hay registered 46° C. or 114° F. It had then probably parted with practically all its uncombined water, for when removed from the heat it slowly gained in weight from absorption of moisture. The dry weight amounted to 42% of the fresh weight.

Fifty grams of the desiccated material, in two portions, were then thoroughly burned in a platinum crucible, and the ash weighed. One portion gave a little less than 5% of ash and the other a little more, so that we may call 5% the average. This is less than most terrestrial herbs have, but more than some. A partial analysis of the ash made for me by the chemist of the Geological Survey of Alabama, showed approximately 27% of potash and $\frac{1}{2}$ of 1% of soda, which figures are

neither very high nor very low when compared with other kinds of foliage.*

It would be interesting to try this simple experiment on other epiphytes, not only ferns, but mosses and lichens and flowering plants too, in warm climates where aerial spermatophytes are available. Possibly few botanical laboratories are provided with the requisite incinerating apparatus, but in the case of those connected with colleges there is usually a chemical laboratory near by. If the services of a competent chemist could be enlisted the ash of many such plants might be analyzed, with results not only interesting from an ecological standpoint, but perhaps also of diagnostic value in distinguishing related species.

For accurate results certain precautions should be observed, such as collecting all the material from the same tree or same kind of tree, washing off any possible dirt and dust, testing it at different seasons of the year or taking old and young foliage separately, etc. It would be a simple matter also to determine at the same time the ash content (with analysis if possible) of the bark on which the plants grow.

UNIVERSITY, ALA.

Another "Freak" Equisetum

J. C. NELSON

While collecting on the southwest slope of Mount Jefferson, in Linn County, Oregon, on Aug. 13, 1919, in company with Professor M. E. Peck, we found that the delta at the east end of Pamelia Lake (altitude 4000 feet) was occupied by an almost pure growth of a tall *Equisetum* with freely-branching, rather weak

* For ash determinations of several types of herbaceous vegetation on Long Island see Plant World 21: 43–46. 1918.

stems, of the section Eucquisetum, which was unfamiliar to both of us. This delta, formed by the entrance of a considerable mountain-stream from the melting snows in Hunt's Cove, occupied an area of perhaps five acres, making a vivid patch of dark green in the rather arid region surrounding it. The Equisetums averaged about 10 dm. in height, naked below, with 5 to 10 whorls of rather long flexuous branches above, and covered the ground as closely as wheat in a grain-field. The only associates that we observed were *Carex sitchensis*, *Calamagrostis canadensis* and *Cinna latifolia*, none of which were at all frequent.

An examination of the specimens that I brought home led me to the conclusion that the plant was *E. fluviatile* L.—a determination kindly confirmed by Professor L. S. Hopkins. This is a species of very wide range both in North America and Eurasia, although not to my knowledge previously collected in Oregon. The range for the Pacific Coast given by Piper in his Flora of Washington (p. 86. 1906) is "Alaska to Washington." Henry in his Flora of Southern British Columbia (p. 9. 1915) gives it as "Alaska to Oregon," but cites no specimens to confirm it. The herbarium of the University of Oregon contains no specimen from the Pacific slope. The fact that this is its first occurrence in five years of assiduous collecting shows that it is at least not frequent here.

Of the plants observed, not above one in fifty bore the fruiting cone, the apex of the others being wholly sterile. The "freak" specimen, to which our attention was specially directed, may be briefly described as follows:

Total height of stem, 8 dm., naked for 5.3 dm. above the base, then 7 whorls of branches and a normal strobile at the apex. The uppermost whorl was composed of 16 branches, the longest measuring 8.5 cm. Fifteen of these branches bore strobiles at the tip,

Equisetum fluviatile, var. polystachyum
Photograph by L. S. Hopkins of specimen collected by J. C Nelson.

smaller than the normal one at the apex of the plant, the latter being 2 cm. long, while the largest of the 15 on the branches measures only 8 mm.

The next whorl below this was made up of 22 branches, the longest 9 cm. Sixteen of these also bore cones, the largest being about 1 cm. long. No cones were observed on any branches below those of the two upper whorls.

Mr. C. A. Weatherby, who has very kindly looked up the literature of this interesting form, informs me that it is known as *E. fluviatile* var. *polystachyum* (Brückn.) A. A. Eaton, Fern Bull. x. 74(1902), and that at the time when Eaton published the new combination but one specimen had been known to occur in the United States, collected by J. B. Flett at Tacoma, Wash. The form seems to be well-known in Europe, however, having been originally described by Brückner as *Equisetum polystachyum* in 1803 (Fl. Neobrand. Prod. 63), and has since his day acquired a synonymy quite too formidable to be reproduced here.

In one other specimen collected, the terminal cone, instead of being solitary, bore a smaller one on each side of it, giving a sort of fleur-de-lis effect to the apex of the stem, and seeming to indicate that the evolution of the species is still in a state of very unstable equilibrium.

The specimen with the fruiting branches has been deposited in the Herbarium of the Fern Society (my no. $2781\frac{1}{2}$), and the writer is indebted to the kindness of the Curator, Professor L. S. Hopkins, for the illustration here presented.

SALEM, OREGON.

Willoughby Lake, Vt., a Candidate for the Title of "Richest Fern Locality"

E. J. Winslow

In the early numbers of the Fern Bulletin several local fern floras were published in friendly competition for the title of "Richest Fern Locality." The ferns of Scolopendrium Lake in Jamesville, N. Y., were listed in the October, 1897, number by L. M. Underwood. This was followed in the next number by Mrs. Terry 's account of her collections in Dorset, Vt., and a little later by an article on the ferns of Pittsford, Vt., by Miss Slosson. In 1905 Mrs. Terry published a supplement to her Dorset list adding two new species and several forms and hybrids. Two of these regions are unique in rock formation and soil character, the other two are largely typical of much of the limy hill country of New York and New England. A brief comparison of the lists from these four localities may not be wholly without interest.

As a basis for such a comparison it is necessary to adopt some ruling as to what shall be counted as distinct species. *Dryopteris Clintoniana* and *D. intermedia*, both of which were counted as varieties in the early lists, are now generally rated as species. That member of the genus that was once called var. *dilatata* and more recently var. *americana* seems to me to deserve specific rank, and it is so counted in this article, though as far as I know it has never been given a specific name. It is clearly impossible, with the information at hand, to tell how the early lists would be affected by Prof. Butters's segregation of *Athyrium Filix-femina*, so for the present purpose I have adhered to the old name. I have omitted all hybrids, including *Dryopteris Boottii*. The Ophioglossaceae are left for separate comparison at the end of the article.

Proceeding upon this basis I find that Underwood's list shows 24 species in the immediate vicinity of Scolopendrium Lake and 29 included by extending the area under consideration to a diameter of three miles. Three species not mentioned in Dr. Underwood's article were listed at the field meeting of the American Fern Society in 1915, making 32 species for the whole Green Lakes region. Mrs. Terry named 34 species within walking distance of Dorset; Miss Slosson also gives 34 for Pittsford, and the Willoughby list has 35.

Twenty-seven species are common to all four localities, *Polypodium vulgare*, *Adiantum pedatum*, *Pteridium latiusculum*, *Cryptogramma Stelleri*, *Camptosorus rhizophyllus*, *Asplenum Trichomanes*, *A. Ruta-muraria*, *Athyrium acrostichoides*, *A. Filix-femina*, *Phegopteris Dryopteris*, *Dryopteris Thelypteris*, *D. noveboracensis*, *D. cristata*, *D. Clintoniana*, *D. spinulosa*, *D. intermedia*, *D. Goldiana*, *D. marginalis*. *Polystichum acrostichoides*, *Cystopteris bulbifera*, *C. fragilis*, *Dicksonia punctilobula*, *Onoclea sensibilis*, *Pteretis nodulosa*, *Osmunda regalis*, *O. cinnamomea*, *O. Claytoniana*.

Scolopendrium vulgare is the particular prize of the Green Lakes region. *Phegopteris hexagonoptera*, which is not reported from either of the Vermont stations, is included in Underwood's list but was not found by the Fern Society members in 1915. Dorset has *Polystichum Braunii* while Pittsford has *Pellaea atropurpurea*, otherwise the lists for these localities are practically identical. Willoughby has both these species and, thanks to its boreal conditions, three species not found in any of the other localities, *Asplenium viride*, *Woodsia alpina* and *W. glabella*. All but Willoughby have *Asplenium platyneuron* and *Athyrium angustifolium* and these might be added to the Willoughby list by extending the area to a length of fifteen miles or so. There are four other species which are found in two or more of the stations.

The general similarity of the four lists is shown by the fact that the four combined include only 40 species, which is only 6 less than the list for all New England and New York, north of Connecticut. The missing six are *Dryopteris fragrans*, *D. Filix-mas* and four coastal plain species, namely the two Woodwardias, *Dryopteris simulata*, and Lygodium.

All the stations report *Ophioglossum vulgatum*. Of the seven Botrychiums named in Gray's Manual the Green Lakes and Willoughby have all except *B. angustisegmentum*. The other two localities lack *B. Lunaria*, and Dorset fails to report *B. simplex*. It is hardly conceivable that it is not there.

AUBURNDALE, MASS.

The Irresistible Charm of the Ferns

EDWARD HALE CLARKSON

"Why a fern should fill one mind with strong emotion and a spray of moss another" wrote Philip Henry Gosse in his "Romance of Natural History" nearly sixty years ago "we can give no reason. Yet that such is a fact every admirer of nature who has an element of poetry in his soul will admit." "The desire" said Humboldt "which we feel to behold certain objects, is not excited solely by their grandeur, their beauty, or their importance. In each individual this desire is interwoven with pleasing impressions of youth, with early predilections for particular pursuits and the love of an active life."

How vividly I recall a most eventful walk with a congenial friend and nature-lover on a certain crisp and sunny autumn day many years ago, to a charming bit of woodland just across the Merrimac River from Newburyport! Climbing a stone wall, in a few minutes

we were apparently in the heart of a rather open cedar forest. All around were fine specimens of these trees, some with a dark olive foliage, others of a lighter green and many of them profusely covered with clusters of beautiful grey-blue berries. Mossy ledges protruded from the higher parts of the ground, their sloping tops and sides adorned with great sheets of the Polypody. All about were barberry bushes with their pendent clusters of crimson fruit, and at my feet was the decayed stump of what was once a big tree, now completely covered with gay red-tipped coral-moss. But most wonderful of all, I saw for the first time growing on the sides of the rocky knolls, the rosettes of the Ebony Spleenwort, surmounted by the tall, graceful fertile fronds with their polished dark brown stems. It was a case of love at first sight, and right then and there began my interest in our native ferns which was destined to later become a veritable hobby.

In the literature of England and Scotland we find many references to the beauty of the ferns or to some romantic superstition connected with them.

In Guy Mannering, for instance, the farmer of Charlie's Hope, honest Dandie Dinmont, after telling Harry Bertram that the sheriff is searching everywhere for the gipsy, Meg Merilies, and that a reward of fifty pounds has been offered for her apprehension, says "But she'll no be taen unless she likes for a' that." "And how comes that?" asks Bertram. "Oh, I dinna ken," replies Dinmont. "I daur say it 's nonsense, but they say she has gathered the fern seed and can gang ony gate she likes like Jock-the-Giant-killer wi' his coat o' darkness and his shoon o' swiftness."

Any one who has read Blackmore's superb novel "Lorna Doone" will remember how narrowly John Ridd escaped a violent death at the hands of his mortal enemies, the Doones of Bagworthy, when those

desperate men led by the great villain, Carver Doone, armed to the teeth and on murder bent, passed by in the woods of Plovers Barrows. Fortunately he heard them coming through the bushes before they saw him. "I had no time to fly," he said, "but with a sort of instinct threw myself flat in amongst the thick fern and held my breath and lay still as a log." Thanks to the "thick fern" John escaped discovery, and later on led an armed expedition into Doone Valley which destroyed this band of cut throats and robbers who had terrorized the neighborhood for so many years.

Although it is true that not nearly as many references to the ferns are to be found in the books of our writers as in those of England and Scotland, nevertheless that there is, here in America, a most wide-spread and enthusiastic interest in these beautiful plants can be easily shown.

"If you wish to know the ferns," wrote Mrs. Frances Theodora Parsons, in her easy and graceful style, "you must follow them to nature's most sacred retreats. In remote, tangled swamps, overhanging the swift noiseless brook, in the heart of the forest, close to the rush of the foaming waterfall, in the depths of some dark ravine, or perhaps high upon mountain ledges, where the air is purer, and the world wider, and life more beautiful than we had fancied, these wild graceful things are most at home."

In his book on "Ferns" beautifully illustrated by photographic reproductions that clearly show the artistic temperament of the author, Campell E. Waters thus describes the Bulblet Bladder fern. "Sometimes in shaded ravines we come across patches of this fern with its fronds hanging down over the moist rocks as if trying to hide their bareness. The delicate leaf-like curtain formed of the slender interwining fronds is one of the most beautiful sights of the woods. There

is an airiness, a gracefulness about the the pose of these ferns, and their color is such a delicate fresh green that it has few rivals among our ferns. It is a worthy member of that chosen company dwelling in moist limestone ravines. We may expect rare ferns even on an exposed limestone cliff, but where the rock is shaded and dripping with moisture it seems as if nature were trying to outdo herself. The rocks seem to retain some of the life of past ages, and the shells slowly formed in the depths of the sea, are now wasted away in supporting a luxuriant vegetation."

"What red-letter days we fern-hunters have," wrote James A. Bates in the Fern Bulletin in 1894.

"I don't think we are naturally any more enthusiastic than other people, but we can tell just when and where we found such and such little rock ferns years ago, and now and then the finding of a rare one in an unexpected place does us more good than it would to find a purse of money (the owner would be sure to come for that!).

"My friends will probably testify that I am a quiet sober, matter-of-fact sort of character, but I am afraid I just stood still and shouted hurrah! when I first saw the Woodwardia Virginica."

Willard N. Clute wrote most charmingly regarding the Chittenango Falls locality for the Harts Tongue in the Fern Bulletin of October, 1897. "It is a wild and beautiful locality, just the spot to serve as a hiding place for botanical rarities. A large stream, the Chittenango, hurrying northward to Oneida Lake, here makes a plunge of many feet over a double series of falls, and winds away through a narrow wooded glen, hemmed in by great precipices of corniferous limestone, which echo the roar of the waters and are always damp with their spray. The shadier parts of these cliffs shelter the Walking Fern and Slender

Cliff Brake, while from every dripping ledge, the long tapering fronds of the Bulbiferous Bladder Fern hang like a curtain. On the sunnier walls the Purple Cliff Brake and Rue Spleenwort find a home. Ever since the Chittenango cut its channel through these rocks, wind and weather have been steadily at work tearing them to pieces. Huge banks of rock fragments slope from the base of the cliffs to the water. Over them the falling leaves of centuries have spread a soft yielding carpet of mould that affords a congenial soil for such trees as Basswood, Hemlock, Striped Maple, Cedar and others. In the shade of these, where there is always semi-twilight, the Harts Tongue elects to grow . . . so lightly are the plants anchored in the yielding soil that they may be easily lifted out, roots and all, without digging. We find ourselves wondering how they manage to exist with such a precarious foothold, but the number of young plants to be seen testifies to their vigour. In September the spores are ripe and then nearly every frond is loaded on the under side with velvety brown lines that look like embroidery."

"The Ferns," wrote George E. Davenport in the Bulletin of 1902, "appeal irresistibly to everything that is best within us."

It is not always the largest and showiest of the ferns that gets the most attention. Writing of the little Rusty Woodsia, C. F. Saunders said, "Woodsia Ilvensis is one of the most interesting of our native ferns, and the unpretentious but sturdy, unwavering fight of the furry little plant with the sun and frost will speedily win for it, I think, a place in the heart of anyone who will give it due attention."

To prove that this little fern's struggle for existence is very real, two photographic reproductions are shown. The first (Plate 7) pictures a colony with fronds curled up, and apparently dying as the result of very dry

weather; the second, (Plate 8) the same colony as it appeared forty-eight hours later, after a good soaking rain, in as good condition as ever. When the period of dry weather is long drawn out, it sometimes happens that the colonies of this fern on the driest parts of the rocks are too far gone to recover.

Quotations from other most interesting American writers could be given if space permitted, but surely enough evidence has been presented to prove "the irresistible influence that has captured and controlled the intellect" of many of us.

Of course we are all duly impressed by the technical and scholarly descriptions of the ferns by our recognized experts, and we realize that they are a most important and necessary part of this publication. Yet I feel that articles such as I have quoted, from the pens of those who are enthusiastic writers on the less technical phase of what might be termed "the romance of the ferns in their homes" would be sadly missed from FERN JOURNAL. By all means let us have more of them!

For, to quote from our friend Gosse once more, "there are more ways than one of studing natural history. There is Dr. Dryasdust's way which consists of mere accuracy of definition and differentiation, statistics as harsh and dry as the skin and bones in the museum where it is studied. There is the field-observer's way, the careful and conscientious accumulation and record of facts bearing on the life history of the creatures, statistics as fresh and bright as the forest or meadow where they are gathered in the dewy morning. And there is the poet's way who looks at nature through a glass peculiarly his own, the aesthetic aspect, which deals, not with statistics but with the emotions of the human mind." "In my many years wanderings through the wide field of natural history, I have always felt toward it something of a poet's heart though destitute of a poet's genius."

Woodsia Ilvensis

Curled up and drooping after long period of dry weather.

Woodsia Ilvensis

The same colony 48 hours later, refreshed by a good soaking rain.

"As Wordsworth so beautifully says,
'To me the meanest flower that blows can give
Thoughts that do often lie too deep for tears.'"
NEWBURYPORT, MASS.

Recent Fern Literature

Dr. W. N. Steil has published a careful and detailed study of apogamy in *Nephrodium hirtipes* Hook.[1] This species appears to depend entirely on asexual reproduction. In his cultures, Dr. Steil avoided conditions likely to induce apogamy; fertilization took place in the usual fashion on prothallia of other species grown in the same cases. But those of *N. hirtipes*, though they developed normally from the spores, produced no sexual organs in most instances and in any case only antheridia. The plant of the spore-bearing generation always arose as a direct outgrowth from the prothallium. In at least one other apogamous species, fusions between the vegetative cells of the prothallium have been observed to precede the growth of the young plant; but even this substitute for fertilization was lacking in *N. hirtipes*.

Dr. Steil gives a detailed account of the cell-changes which accompany the growth of spores in this species. They present some unusual features. In particular, the mother-cells from which the spores are eventually formed undergo a partial division, never fully completed, at an early stage of their growth and, probably because of this, sometimes produce six spores to the cell instead of the usual four—the latter a phenomenon never before observed in cryptogamous plants, though a similar one has been noted in certain phaenogams.

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[1] Steil, W. N. Apogamy in Nephrodium Lirtipes Hk. Annals of Bot 33: 109–132. pls. 5–7. Jan., 1919.

Prof. E. W. Berry[2] has described as new, under the name *Matonidium americanum*, a species of fossil fern found in certain sandstone formations in Colorado. According to Prof. Berry's restoration, this fern bore, in life, numerous narrowly lanceolate pinnae, themselves pinnatifid, arranged fan-wise and spreading horizontally at the top of a stout stipe. This is the habit of its living relative, *Matonia pectinata*.

The genus *Matonidium* belongs to the family *Matoniaceae* which now consists of but one genus, with three species, all of which occur only in the uplands of the Malay Peninsula and the island of Borneo. They are survivors of a dying race which in earlier geologic times inhabited a vastly wider area. Representatives of one of the older fossil genera of the family, *Laccopteris*, have been found in both hemispheres, as far north as Greenland and Spitzbergen and as far south as Australia. Of *Matonidium* three species are known, one found in Europe, one in western North America and one in both regions. It may be noted that this distribution is strikingly like that of various living species or pairs of closely related species--such as, for instance, *Dryopteris Oreopteris*, *Athyrium alpestre* and *A. americanum*, *Polystichum aculeatum* and *P. Dudleyi*.

Mr. Maxon[3] has described two new species of tropical American ferns. One, *Alsophila scabriuscula*, is a tree-fern of Guatemala and the State of Vera Cruz, Mexico. The other, *Cheilanthes castanea*, is the

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[2] **Berry, E. W** A new Matonidium from Colorado with remarks on the distribution of the Matoniaceae. Bull. Torr. Bot. Club **46**: 285 294, p's 12, 13, figs. 1 and 2. Aug., 1919

[3] Maxon, W. R. A new Cheilanthes from Mexico. Proc. Biol. Soc. Washington **32**: 111 112. May 20, 1919. **A new Alsophila from Guatemala and Vera-Cruz. Proc. Biol. Soc. Washington 32: 125-126. June 27, 1919**

fern of northeastern and central Mexico which has hitherto passed as *Cheilanthes gracillima* Eaton. From that species of the western United States it differs, Mr. Maxon finds, in its greater size, in having hairs instead of scales on the upper surface of the frond and in the characters of its scaly covering.

Prof. Vaughan MacCaughey[4] has published an ecological survey of Hawaiian pteridophytes. The most striking feature of the Hawaiian fern flora is the extraordinarily high proportion of species which are found nowhere except in these islands—123 out of 190.[5] This is due to the long isolation of the Hawaiian archipelago. The endemic species are very irregularly distributed among the different islands. Kauai has the most; Oahu is next; Hawaii, though much the largest in area, has the fewest. This, Prof. MacCaughey points out, furnishes striking corroboration of the generally accepted belief that the western islands are older and have been longer isolated than the eastern. It is just in the regions supposed to be geologically the oldest that the richest fern-flora is found.

Prof. MacCaughey divides the ferns into two series of groups, one based on their distribution in point of altitude, the other on their preference for wet, medium, or dry habitats. He closes with an annotated list of all the species known to occur on the islands.

SOME CURIOUSLY CUT SPECIMENS OF DRYOPTERIS BOOTTII.—In August last while searching for Dryopteris hybrids in Washington, Mass., my son found a very

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[4] MacCaughey, Vaughan. An ecological survey of the Hawaiian pteridophytes. Journal of Ecology 6: 199-219. Nov. 30, 1918.

[5] The type-setter, not Prof. MacCaughey, is doubtless responsible for the statement in the text that 195 out of 190 species are endemic—a remarkable percentage indeed!

curiously cut variety. It was apparently badly eaten by bugs, but upon examination we found that the subdivisions of the pinnules were untouched. Their outlines were without any sign of such attack. The serrations and indentations and the teeth were normal, not irregular as would have been the case if they had been eaten by bugs. We thought we had found a new hybrid. Later, specimens were identified as "Bug eaten specimens of *D. Boottii*."

Meanwhile we had gone back to the place in the swamp where the specimen had been found and found the plant. Looking about we saw that there were several similarly marked plants of the same variety, so we dug up a root. Quite accidentally, so far as the result was concerned, I sliced the rootstock. In the middle of it I found a longitudinal channel, evidently bored by some bug. Not only so, we quickly found the bug itself. It was a white grub perhaps an inch and a quarter long. Its head was a lightish brown, and covered with what seemed like a hard shell. Along the sides ran a row of black hairs in tufts.

Upon finding this we proceeded to dig up other specimens, five in all. All were marked alike, all evidently *D. Boottii* or some form of it and in every case we found not only the channeled rootstock but the grub within that had done the deed. Crossing the road into another piece of swamp perhaps three hundred feet away we found the same condition in one or two ferns that we picked there.

Later in the month we found a similarly cut fern of the same variety in a piece of swamp a mile away. This specimen while showing the outward signs of injury to the rootstock did not seem to have been eaten in the same way. Nor did we find the grub. It was the only exception, however, to the presence of this borer grub, among those which we examined.—C. S. LEWIS, *Burlington, N. J.*

LYCOPODIUM COMPLANATUM VAR. FLABELLIFORME WITH SEVEN SPIKES.—In recently working over some undistributed material in the Pennsylvania herbarium at the Carnegie Museum I found a specimen of *Lycopodium complanatum* var. *flabelliforme* Fernald, apparently typical of that variety excepting that the fruiting stem carried two peduncles, each subtending seven well developed spikes averaging about two centimeters long. The distances between successive forks, as well as the immediate pedicels of the spikes, range from about 4 to 8 mm., but at the second forking of the peduncle one of the branches remains undivided and constitutes thus a pedicel for its spike about 11 mm. long. The specimen was collected by O. P. Medsgar, Dec. 27, 1899, along Jacobs Creek, which flows in a rather wild valley in an almost mountainous region of southwestern Pennsylvania.—O. E. JENNINGS, *Pittsburgh, Pa.*

A NEW STATION FOR CYRTOMIUM FALCATUM AND PTERIS LONGIFOLIA IN ALABAMA.—Mr. W. C. Dukes reported in the Fern Bulletin for July, Vol. XV, No. 3, of having located a station for *Cyrtomium falcatum* (*Aspidium falcatum*) near Prattville, in Autauga County, Alabama.

Last year I noticed a fern growing along the street near the Ashland Place, on the north side of Spring Hill road, just west of the city limits of Mobile. This year I examined it more closely and found it to be a good sized plant of *Cyrtomium falcatum*. As it was growing in the corner of a yard of a dwelling house, I called at the house and asked the occupants if they had set the fern there. On their replying in the negative, I asked how long it had been growing there, I was told it was there four years previous when they moved into the house.

It appears to be a very old plant for the rhizome is large and covered with rough scales, and has grown out in two directions, the ends being about eight inches apart. One end was dead, but the other though still alive was being used badly by chickens that had been scratching at it. It was growing in a rather dry place near the end of a brick wall under *Crepe Myrtle* (*Lagerstroemia indica*, L.) bushes. There might have been more plants but for the chickens.

I found a dozen or fifteen plants of *Pteris longifolia* L. growing on the brick wall of an old building on Congress street, near Davis Avenue in the city of Mobile. There are growing with it *Pteris serrulata*, L. and *Dryopteris patens*, (Sw.) Kuntze and several kinds of weeds. The wall is covered with moss and is shaded by a tree. I have observed it growing there for two years. It may be found in other parts of the city but this the only place I have seen it growing. This fern is not reported in Mohr's Plant Life of Alabama, and as far as I know this is the first time it has been reported from the state. —E. W. GRAVES, *Spring Hill, Ala.*

ON THE VIABILITY OF CERTAIN FERN SPORES.—The spores of some of our common wild ferns germinate only a short time after they have reached maturity as, for example, those of the *Osmunda* species which remain viable for only a few days. In other species as *Pteris aquilina* L. the spores are known to retain their power to germinate for two years.

Beginning with the summer of 1910, the writer collected in the vicinity of Madison fronds of a number of species of ferns. The spores of all the species which germinated a short time after they were collected were kept in packets in the botanical laboratory. The spores of the different species were sown again October 4,

1918, on the surface of tap water and nutrient solutions. The spores of three species proved to be especially long-lived. Those of *Pellaea atropurpurea* L. collected eight years ago possess a very high percentage of germination. Woronin* (1908) sowed spores of *Notholaena Ecklioniana* Kunze, a species closely related to *Pellaea*, and found that they germinated twelve years after they had been collected. Spores of *Pellaea gracilis* Hook collected by the writer in 1912 still germinate. The spores of *Aspidium thelypteris* Swartz collected in 1911 germinate at the present time, but not so abundantly as those of the other two species.—W. N. STEIL, *University of Wisconsin, Madison.*

A NEGLECTED CHARACTER IN THE BEECH-FERNS.—Most of our fern books, from Eaton's *Ferns of North America* on, make the statement that the long and broad beech ferns, though undoubtedly different species, are often hard to tell apart; and amateurs may frequently be heard to complain that the statement is only too true. So it is if leaf-form alone is considered; for in ferns, as in other plants, the leaf is apt to vary considerably in shape and cutting with age and from the effect of external conditions. But there is one detail which the writer, in the examination of some scores of specimens, has found nearly invariable and very helpful in deciding doubtful cases.

This character is to be found in the scales which in both species are borne along the main mid-rib on the under side of the frond. They are too small to be seen clearly with the naked eye, but can be readily made out with a low-powered magnifying-glass, such as most of us possess. In the long beech fern they are rather

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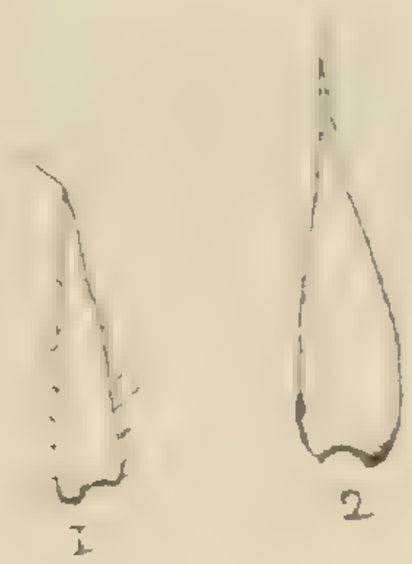
* Woronin, Helene. (1908) Apogamie und Aposporie bei einigen Farnen. **Flora 98: 101–162. f. 1–72.**

numerous, comparatively broad, and pale to bright brown in color. In the broad, they are fewer, sometimes almost entirely absent, narrower than in the other species and usually white or nearly so. The color test may fail, though rarely, but the shape of the scales, once you have learned to recognize it, is a practically certain index to the species.



In the accompanying sketch, fig. 1 represents a scale of the broad beech fern magnified eight times (about the power of the ordinary lens), fig. 2 one of the long beech on the same scale. The marginal hairs shown in fig. 1 are not a good distinctive character; ciliate scales may occur in both species.—C. A. W.

RECORDS OF MONOMORPHIC EQUISETUM TELMATEIA—In his note in the last number of the JOURNAL, Mr. J. C. Nelson asks if the monomorphic tendency in this species has been observed by other collecters either in this country or Europe. I have no personal experience to relate, but can perhaps give some information as to records in books not readily accessible to all readers of the JOURNAL.

I find no recorded collections from North America other than the "two specimens from British Columbia" mentioned by A. A. Eaton in his account of the North American species of Equisetum in the Fern Bulletin and the records from New Westminster, B. C., given by Prof. Henry in his recently published *Flora of*

Southern British Columbia. Both these records are probably based on collections by Mr. A. J. Hill, one of whose specimens is in Eaton's herbarium at Harvard. There are there, also, two other monomorphic specimens, one collected on the "lower Fraser River, 49 N. Lat." by Dr. Lyall in 1859, the other by Mr. J. B. Flett at Tacoma, Wash., in 1901.

In Europe, monomorphic forms are well known. Milde, in his monograph of the Equisetums, distinguishes two kinds of them. In one, which he calls var. *frondescens*, the fertile stem instead of dying, as usually happens, when the spores are ripe, persists and sends out green branches from at least some of the joints, the fruiting cone and the upper part of the stem withering away. In the other, var. *serotinum*, the sterile stem produces, late in the season, a fruiting cone at the apex. Luerssen says the first form is rather rare but that the second "may be expected occasionally wherever *E. Telmateia* occurs." European botanists agree with Mr. Nelson that drought is the probable cause of these queer forms. Francis, in his book on British Ferns,[1] states that var. *serotinum* can be produced at will in specimens grown in pots simply by cutting off the supply of water at the proper time.

The proliferous form mentioned by Mr. Nelson, in which the stem grows up through the fruiting cone has also been found in Europe. Milde calls it "var. *serotinum d) proliferum.*"—C. A. W.

American Fern Society

Shortly before this number of the JOURNAL went to press, the editors received an interesting and welcome letter from one of the members. In it he said: "It

[1] Quoted by Clute in *The Fern Allies*, p. 52.

has occurred to me that some interesting articles might be written for the AM. FERN JOURNAL giving short biographical accounts of some of the fern sharps whose names so often appear in the botanies. Pursh, Nuttall, Scott and many others, amateurs like myself (and I imagine most of the members of the Fern Society are not professionals) would like to know something about.

"Again, the specific names of ferns might afford an instructive article, as many of us would like to know what they mean."

Another member writes that, in her opinion, something in the nature of a "primary department" would be desirable in the JOURNAL. "A paper, clear and plain, on some familiar fern and intended for novices in fern study, bringing out some points almost forgotten by advanced students, such as the change in form from the newly uncurled frond, or the wonderful choice of habitat—bringing out the uselessness of hunting for certain ferns where they are unwilling to grow—and other noticeable points—it seems to that such help would be useful to beginners and would be appreciated by them."

The editors are very glad to receive such criticisms and suggestions; we wish more of them were sent in to us. We propose to act on these in future numbers so far as we can. But our available time and our ability are not unlimited; we shall greatly appreciate help in the form of articles along the lines suggested from members who are in a position to write them.

While in Westmore, Vt., last August I found an abundant growth of *Equisetum pratense* and collected enough for about 25 sheets. These specimens show the plant in good midsummer condition without fruit except the unexpanded next year's fruiting branch

which appears near the base of the main sterile branch. These will be sent to any members of the Fern Society who apply sending a self-addressed envelope not less than nine inches long and bearing a two cent stamp. —E. J. WINSLOW, *Auburndale, Mass.*

To their regret, the Editors have again to apologize for a late number—a state of things due largely to difficulty in getting together sufficient copy. We are glad to say that copy enough for no. 1 of the next volume is already in hand and that number should be well under way before this one reaches our readers.

If late, this is an extra-illustrated number. We are much indebted to Mr. E. H. Clarkson for the fine photographs from which the two plates accompanying his article were made and for defraying the expense both of the plates and of running them as a double-page insert. Thanks are also due Prof. Hopkins for making specially for us the photograph from which Plate 6 was taken.

Report of the Judge of Elections

TO THE SECRETARY OF THE AMERICAN FERN SOCIETY:

As Judge of Elections of the Society, I make the following report of the election of Officers held in October, 1919:

Whole number of votes, 91.

For President		*For Secretary*	
William R. Maxon	91	Stewart H. Burnham	91
For Vice-President		***For Treasurer***	
Miss M. A. Marshall	90	Jay G. Underwood	90

I therefore declare the above persons elected.

DANA W. FELLOWS, *Judge of Elections*

Portland, Maine, Nov. 5, 1919

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ERRATA

Page 25, lines 7 and 8. For mate,rial, read mater-ial.
Page 30, line 17. For thouroughly, read thoroughly.
Page 30, line 24. For leaedrship, read leadership.
Page 32, line 8 from bottom. For to, read too.
Page 66, line 6. Delete the asterisk.
Page 66, line 7. Insert an asterisk before the name of Miss Blanche Turner.
Cover-page 1 of no. 2, line 1. For April-July, read April-June.
Contents of no. 2, line 7. For N. C. Bigelow, read H. C. Bigelow.
Contents of no. 3, line 2. For cristatum marginale, read cristatum × marginale.

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American Fern Journal

Vol. 10 JANUARY–MARCH, 1920 No. 1.

Notes on American Ferns—XV[1]

By William R. Maxon

Equisetum fluviatile L. Supplementing Mr. Nelson's record of the occurrence of this species in Oregon, in the last number of the Journal, the following additional specimen from another locality in that state may be mentioned: Lowlands along the Willamette River, five miles south of Corvallis, July 6, 1918. *William E. Lawrence* 1904.

Lycopodium alopecuroides L. This species, mentioned in a recent number of the Journal[2] as one of the few likely to be added to the District of Columbia fern flora through further exploration in the coastal plain region east of Washington, was found by the writer, on September 26, 1919, in the magnolia bog near Suitland, Maryland, which Mr. Paul C. Standley has recently described[3] in connection with the local discovery of *Senecio Crawfordii*. The plant, which was not very abundant, was nearly confined to deep tussocks of sphagnum within a small area at the very wet lower border of the bog, in partial shade. Only a few individuals were fertile. The arched sterile stems were equally characteristic, however, offering the strongest contrast to the closely prostrate sterile parts of *L. adpressum*, which grew near by, rooting along their entire length. That

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[1]Published with the permission of the Secretary of the Smithsonian Institution.

[2]9: 41. 1919.

[3]Rhodora 21; 117–120. 1919.

[Vol. 9, No. 4 of the Journal, pages 99-130, plates 6-8, was issued Jan. 24, 1920.]

L. alopecuroides had been overlooked in this bog, which has been known to botanists for several years, is doubtless due to its development late in the season, at which time the bog had probably not been visited by collectors. The nearest previous locality for this species is, apparently, that listed by McAtee[4] for Newcastle County, Delaware.

LYCOPODIUM ALPINUM L. Though known in North America from the Gaspé region of eastern Quebec, from abundant material collected in Alaska, and from a few specimens collected as far south as the Revelstoke region of British Columbia (*Shaw* 40, 894, 959 in part), this species appears not to be recognized as occurring within the United States. The present record relates to excellent fruiting specimens collected in the vicinity of Snyder Lake, Glacier National Park, Montana, at an altitude of about 1,500 meters, August 23, 1919, by Mr. Paul C. Standley (no. 17957), while engaged in gathering material for a descriptive flora of the Park. The plants, which were remarked as being of a very pale color, were collected at the edge of a rock slide, under blueberries. Specimens from Mount Paddo, Washington, have been distributed under this name by Mr. Suksdorf, but the material so labeled proves to be *L. sitchense* Rupr.

POLYSTICHUM JENNINGSI Hopkins. Among other interesting ferns brought back from Glacier National Park, Montana, by Mr. Standley are two numbers of Polystichum which seem to bridge the supposed gap between *P. Jenningsi* and *P. Andersoni* Hopkins, whose status was recently discussed by the writer.[5] They are: *Standley* 17443, collected in an alder thicket near a brook, along the lower part of the trail from Many Glacier Hotel to Piegan Pass, at an altitude of about 1,500 meters; and

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[4]Bull. Biol. Soc. Washington 1: 84. 1918.

[5]Amer. Fern Journ. 8: 33–37. 1918.

Standley 16107, collected on a steep brushy and wooded slope, under alders, near Grinnell Lake, at 1,500 to 1,650 meters elevation. The specimens of both collections are fertile and apparently grew under favorable conditions. Those constituting no. 17443 are unmistakably referable to the form called *P. Jenningsi*, and though only 45 cm. high, and thus considerably smaller than the type specimen (from Rainier National Park, Washington), agree closely with other Washington material previously listed by the writer, differing only in their relatively longer basal pinnae. The specimens collected as no. 16107, however, are about 80 cm. high and, while agreeing with the foregoing material in most respects, closely approach *P. Andersoni* (of which three fronds from the original plant are at hand) in their narrower pinnae and more noticeably awned segments. A critical comparison of Mr. Standley's two collections shows no dependable differences between them, and a review of the whole series indicates a single species in which the leaf blade varies from narrowly lance-oblong to lance-elliptic, the basal pinnae varying from a length of one-third to nearly two-thirds that of the middle pinnae. It seems necessary, therefore, to regard *P. Jenningsi*[6] as a synonym of *P. Andersoni* Hopkins, described a few years earlier.[7]

NOTHOLAENA PARRYI D. C. Eaton. In listing the westernmost stations for *Cheilanthes Feei* not long ago[8] the writer, as a result of too hasty examination, misidentified small specimens of *Notholaena Parryi* from Mountain Spring, California (*Schoenfeldt* 3080), as *C. Feei*. The mistake was noticed in coming upon much better specimens collected at the same locality by Parish (no. 9028) in 1914. The close similarity of the two spe-

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[6]Ann. Carnegie Mus. **11**: 362. *pl. 37*. 1917.
[7]Amer. Fern Journ. **3**: 116. *pl. 9*. 1913.
[8]Amer. Fern Journ. **8**: 119. 1918.

cies is well known, the most obvious difference, as mentioned by Eaton, consisting in the copious covering of slender-pointed but long, coarse, persistent, septate hairs of *N. Parryi*, the upper surface of the blades of *C. Feei* being "scantily furnished with whitish webby hairs" and "never hirsute-tomentose." Moreover, *C. Feei* has the margins of the segments narrowly but regularly recurved, while in *N. Parryi* the margins are slightly if at all recurved, the segments being in fact nearly flat, as in *C. Cooperae*. Although the retention of *N. Parryi* in Notholaena appears never to have been seriously questioned, the plant might with about equal propriety be placed in Cheilanthes, because of its somewhat clavate vein-tips. A comprehensive revision of Notholaena and Cheilanthes and their near allies is urgently needed, including especially the numerous tropical species.

Notholaena Parryi, described originally from St. George, in southwestern Utah, is known to range thence to south-central Arizona and the desert region of southern California. It ascends to 1,740 meters in the Panamint Mountains, Inyo County, California, but is said by Parish to be more abundant at low altitudes, as, for example, at Palm Springs, altitude about 150 meters, on the eastern slope of the San Jacinto Mountains.

WASHINGTON, D. C.

The Fern Flora of Nebraska*—I

T. J. Fitzpatrick

Nebraska lies near the center of the region known as the great plains of North America and near the eastern side of the semi-arid district. The boundaries are natural or nearly so. The Missouri river forms the eastern boundary, the northern boundary lies in the valley of the Niobrara, the southern in the valley of the Republican, while the western boundary is in the foothills. The range is from the 40th to the 43rd parallel and the western border is the 104th meridian. The greatest width is 208 miles, the greatest length is 455 miles, the area is 77,530 square miles, of which 712 square miles are water. As to comparative size, Nebraska is much larger than all of New England and considerably larger than England and Wales together. The elevation varies from 785 feet to about 5390 feet. As a whole the state has the aspect of a rolling prairie, there being plateaus and foothills only in the western portion. The annual rainfall varies from 35 inches along the Missouri river in southeastern Nebraska to 14 inches in the semi-arid districts in the western portion. The mean annual temperature varies from 52° F. in the southeastern corner to 45° in the northwestern corner. The recorded evaporation data give the average annual total amount from April to September inclusive, for Lincoln, during an eleven year period, as 34.8 inches, and for a three year period at North Platte as 41.3 inches.

The physiographic regions of the state are: (1) river valleys, (2) wooded bluffs, (3) prairies, (4) sandhills, (5) plateau or foothill region, (6) pine ridge, and (7) bad lands.

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*Contribution from the Department of Botany, University of Nebraska, No. 30.

River Valley Region

On the eastern side of the state is the narrow valley of the Missouri River. It is bordered by steep and wooded bluffs, broken by numerous ravines. The width varies from half a mile to as much as eight miles. The Missouri river meanders between the bordering bluffs, thus leaving a variable width of valley to the Nebraska side. Horseshoe lakes or lagoons are frequent. The soil is of alluvial origin, being of fine silt and sand. Old woods are frequent.

The Platte river with its main tributary, the North Platte, flows across the state through the central portion from west to east. The width of the North Platte on entering the state is about five hundred feet, the width of the Platte at its mouth is more than a mile. The valley of the North Platte is deep and narrow, usually less than half a mile in width, the valley of the Platte varies in width from one to eight miles. The river banks are low and usually treeless. The water is shallow and frequently divides into several streams which are separated by long sandbars or low wooded islands.

The Niobrara river flows in a narrow gorge for more than two-thirds of its course in Nebraska. The last fifty miles of its course is through a valley varying in width from half a mile to a mile. Here the banks are low and wooded, the bluffs are steep and densely covered with thickets and young trees, and occasionally the valleys are heavily wooded.

The Republican river enters the state near the southwestern corner, flows eastward through eight counties of the southern tier, then turns southward into Kansas. The valleys are rather broad and treeless, the bluffs low and bare of trees, in the ravines are willow, cottonwood, and ash trees, the river banks usually have a fringe of

willows. The river is broad and shallow with frequent sandbars.

The Big Blue river with its tributaries drains much of the southeastern portion of the state. The current is slow, the bed and banks muddy, the valleys broad, level, rich and frequently heavily wooded.

The fern species that may be found in the river valleys are *Osmunda regalis* (rarely), *Dryopteris thelypteris*, and *Onoclea sensibilis*. The fern allies are *Equisetum robustum* and *Equisetum fluviatile*.

WOODED BLUFFS REGION

This region consists of narrow strips of country bordering on the river valleys on one side and the uplands on the other. The line of demarcation with the river valley is rather sharp although the woods are frequently continuous. The separation of the wooded bluffs from the uplands is often not sharply drawn, there being varying degrees of divergence, yet within limits it is distinctive. The wooded bluffs extend in narrow dichotomous strips over much of the state paralleling the valleys of the main water courses. They reach their greatest development near the Missouri river which is the center of their extension westward. Upland woods are an extension from the wooded bluffs into favorable situations. The trees are of the broad leaf species except in the northwest where there is a development of the yellow pine.

In Nebraska the fern flora reaches its greatest development in this region. The principal fern species of this region are *Botrychium virginianum*, *Adiantum pedatum*, and *Filix fragilis*. In the crevices of the rock cliffs, often more or less exposed, are found *Cryptogramma acrostichoides* (rarely), *Notholaena dealbata* (rarely and locally), *Pellea atropurpurea*, *Woodsia obtusa*, and on dry rocky soil *Selaginella rupestris* (rarely).

THE PRAIRIE REGION

The prairies lie immediately west of the Missouri river bluffs and in general cover the eastern half of the state, extending farther westward in the southern portion and are much restricted in the north central portion. These prairies with their gently undulating surfaces are the western representatives of those characteristic of Iowa and Illinois and are made up of indiscriminately arranged series of low rounded swells or hills interspersed with broad shallow depressions or limited valleys. The soil is of glacial drift which is quite deep in many places and is more or less veneered with loess. Drainage systems are well established and ponds or lakes are infrequent or rare.

This region is not conducive to fern growth. Where a belt of upland woods occurs *Botrychium virginianum* and *Adiantum pedatum* may be found. *Onoclea sensiblis* and *Dryopteris thelypteris* occur in wet prairie bottoms. Of the fern allies there are *Equisetum arvense*, preferring dry soil, and *Equisetum laevigatum*, preferring moist soil. Both species are frequent to common and widely distributed in this region. *Equisetum variegatum* is rarely found. In ponds *Marsilea vestita* occurs infrequently or locally frequent. *Isoetes melanopoda* occurs rarely and locally.

THE SANDHILL REGION

The sandhills lie west of the prairies and cover much of the western half of the state, being confined largely to the central and west central portions. The eastern boundary of this region is not well marked, the prairies passing gradually into the sandhills, but in general the boundary line is irregular, receding westward in the river valleys and extending eastward along the water sheds, the greatest eastern extension being in the north

central portion. The western boundary is quite distinct, although there are outlying sandhills in the foothill region. The area is about 18,000 square miles, a little more than one-fourth of the area of the state. The soil is porous and sandy. The hills are broken, abrupt or rounded, frequently pitted with blowouts or crater-like depressions, and the valleys are deep and narrow. The variable contours of the hills and blowouts are the direct result of the prevailing winds. Drainage systems are poorly established. Large ponds and small lakes occur throughout the region and lakes of considerable size occur near the heads of the water courses, particularly in Cherry, Grant and Hooker counties. Lost creeks are numerous. These streams, rising in ponds or springs, flow on the surface for a distance and then sink in the soil to pursue a subterranean course, occasionally coming to the surface for a short distance only to be lost again. The valleys along streams are broad and marshy, their limits marked by high sandhills. Buttes occur occasionally in the western part. This is the bunch-grass region of the state. Woodland vegetation is scanty.

In favorable situations, usually in moist soil, there occur: *Dryopteris cristata* (rarely), *Dryopteris spinulosa* (rarely), *Dryopteris thelypteris* (often locally abundant), *Onoclea sensibilis*, *Woodsia oregana* (rarely), *Marsilea vestita*, *Azolla caroliniana* (rarely). *Equisetum arvense* (in dry soil), *Equisetum laevigatum*, *Equisetum variegatum* (rarely), and *Selaginella rupestris* (locally) which forms mats on hillsides.

THE PLATEAU OR FOOTHILL REGION

The plateau region, in the western part of the state, comes rather abruptly from the sandhill region. It is an elevated district well marked by numerous isolated buttes and by deep and precipitous ravines. It is the short-grass region of Nebraska.

The fern flora of this region is scanty. The following species have been collected: *Cheilanthes feei*, in cañons; *Woodsia oregana*, on buttes: *Marsilea vestita*, in ponds; and *Selaginella rupestris*, on exposed dry situations, often forming dense mats on high hills and buttes.

PINE RIDGE REGION

Pine Ridge is a northerly facing escarpment extending from Wyoming into Nebraska near the northwest corner and in the middle part of Sioux county and extending eastward across Sioux, Dawes, Sheridan and Cherry counties, approximately parallel with the northern boundary of the state. The ridge varies from a mile to several miles in width and has its greatest development in Nebraska in Sioux and Dawes counties. Eastward it becomes lower and narrower. The ridge is much broken by deeply cut cañons crossing transversely to the general trend. Along this ridge upon the cañon sides is a development of the western yellow pine (*Pinus ponderosa scopulorum*). The vegetation peculiar to Pine Ridge extends farther eastward across Brown, Rock and Keya Paha counties. Pine Ridge is essentially a variation of the wooded bluffs region.

In favorable, usually moist situations are found *Botrychium virginianum*, *Athyrium filix-foemina* (rarely) *Cystopteris fragilis*, *Dryopteris spinulosa*, *Dryopteris thelypteris*, *Woodsia oregana*, and *Equisetum laevigatum*.

BAD LANDS REGION

The Bad Lands in Nebraska are confined largely to Sioux and Dawes counties, in the northwestern part of the state, with occasional outliers in the foothill region south of the North Platte river in Scottsbluff county. The region is a rugged, submontane one, marked with deep cañons, mostly drained by Hat creek and White river and their tributaries. The larger part of the region

is known as the Hat creek basin. The soil is largely clays and marls, absorbs little water,and readily erodes. This unstable soil receives little rain and much summer heat, hence there is little or no vegetation.

In favorable situations in the cañons are found: *Botrychium virginianum*, *Filix fragilis*, *Woodsia oregana*, *Equisetum arvense*, *Equisetum laevigatum*,and *Equisetum robustum*.

General Distribution

The fern flora in Nebraska is represented by 17 genera and 26 species. Of these, *Botrychium neglectum*, *Osmunda regalis*, *Osmunda claytoniana*, *Cryptogramma acrostichoides*, *Dryopteris cristata*, *Notholaena dealbata*, and *Isoetes melanopoda* are quite rare, being known from but one locality for each. *Cheilanthes feei*, *Dryopteris spinulosa*, and *Azolla caroliniana* are known from two localities for each. *Pellaea atropurpurea* and *Athyrium filix-foemina* have been collected in three or four localities. *Adiantum pedatum*, a common eastern fern but which ranges across the continent, occurs in Nebraska only in the southeastern quarter. *Botrychium virginianum*, *Filix fragilis*, *Dryopteris thelypteris*, *Onoclea sensibilis*, *Marsilea vestita*, *Equisetum arvense*, *Equisetum laevigatum* and *Equisetum robustum* are the only species that are frequent to common and widely distributed over the state. *Pteris aquilina*, the nearly cosmopolitan species, does not occur, neither does *Polypodium vulgare* nor *Camptosorus rhizophyllus*. There are no Lycopodiums. The nearly cosmopolitan species, *Athyrium filix-foemina*, is found in Nebraska only in two or three favorable localities.

Summary and Conclusions

From this it is readily seen that the fern flora of Nebraska is conspicuous for its poor development. The reasons for this paucity may be due to the effects or

mutual reactions of the effects of several causes. Some of these are:

(1) The greater portion of the state is too arid for a rich development of fern growth; much of the surface is unsuitable for any ferns, the suitable areas being few and restricted, thus limiting the possible number of species.

(2) Entire absence of endemic forms; there are no species peculiar to Nebraska.

(3) Lack of development of features favorable to distributional adaptation; ferns are rather rigid in their requirements and do not readily overcome new environmental difficulties.

(4) Ferns are comparatively old from the standpoint of evolution, being far beyond their period of culmination, while the soil of Nebraska is comparatively new.

(5) The centers of migration for the ferns into this area are the Appalachian and the Rocky Mountains. The broad prairies of northern Missouri, of Iowa, and of southern Minnesota prevent migration from the east. A number of species of ferns that are absent from similar localities in eastern Nebraska are found along the eastern border of Iowa. The aridity of the western portion of the state prevents migration from the Rocky Mountains.

(6) The line of easiest migration into Nebraska is by way of the Missouri river valley, a route suitable to only a limited number of ferns.

(7) Lack of development of a mountain range within the state or near by with a humid climate, the submontane region of western Nebraska being too arid.

(8) The area of fern distribution tends to lessen, many species are now quite limited in range, and ferns as a whole have little migrating tendency.

ACKNOWLEDGMENT

The material on which this paper is based is in the herbarium of the department of botany of the University

of Nebraska. This material was largely collected or contributed during the botanical survey of Nebraska conducted by the botanical seminar, an organization founded and promoted by Dr. C. E. Bessey and his co-workers.

ANNOTATED LIST OF SPECIES

OPHIOGLOSSACEAE

BOTRYCHIUM VIRGINIANUM (L.) Swartz. Grape fern.

In rich woods, preferring bluffs and cañons, rather common in favorable locations.

DOUGLAS COUNTY: woods near Florence, July 9, 1897, *William Cleburne.*

SARPY COUNTY: Bellevue, open woods, June 3, 1887, *William Cleburne;* Bellevue, May 2, 1893, no. 3232, *Roscoe Pound & DeAlton Saunders.*

CASS COUNTY: Weeping Water, June, 1889, *Tom A. Williams.*

LANCASTER COUNTY: Lincoln, June 30, 1886, no. 6102, woods west of Saltillo, *H. J. Webber.*

THOMAS COUNTY: in woods near Plummer ford, Dismal river, July 3, 1893, no. 1467, *P. A. Rydberg;* Halsey, June 18, 1912, *Raymond J. Pool & Donald Folsom.*

DAWES COUNTY: Belmont, wooded bluffs, July 18, 1889, no. 6103, *H. J. Webber.*

SIOUX COUNTY: Squaw cañon, August, 1892, no. 444, *Albert F. Woods;* Monroe cañon, north of Harrison, June 21, 1911, *Raymond J. Pool & C. V. Williams.*

BOTRYCHIUM NEGLECTUM Wood. (*Botrychium ramosum* (Roth) Aschers.).

FRANKLIN COUNTY: one specimen in the herbarium, collected by E. M. Hussong, in August, 1895, copses and meadows on Mr. Ewing's farm, one mile northeast of Franklin, not abundant, no. 4689. It is labeled *Botrychium ternatum australe.*

OPHIOGLOSSUM VULGATUM L. Adder's-tongue.

Rev. J. M. Bates, in *The Fern Bulletin*, vol. 20, p. 67, July, 1912, reports finding a colony of this species in Cherry county, along Snake creek, Kennedy township, forty miles southwest of Valentine, the county seat. No specimens are at hand.

OSMUNDACEAE

OSMUNDA REGALIS L. Royal fern. Flowering fern.

FRANKLIN COUNTY: in original prairie in Republican river valley, near Franklin, May 5, 1896, no. 6776; also one and one-half miles southwest of Franklin, near Ashby mill and on low ground near the river, June, 1896, no. 4693, both specimens collected by E. M. Hussong.

OSMUNDA CLAYTONIANA L.

One specimen, no. 7516, without definite locality, and doubtfully referred to Nebraska.

POLYPODIACEAE

ADIANTUM PEDATUM L. Maidenhair.

This species is frequent to common in rich woods, especially in the southeastern quarter of Nebraska, the region of the state having the greatest rainfall.

DOUGLAS COUNTY: June 29, 1875, *Samuel Aughey:* woods, south of Omaha, June 25, 1873, *William Cleburne;* Florence, October 3, 1908, *N. F. Petersen.*

SARPY COUNTY: Bellevue, September 2, 1893, no. 3146, *Roscoe Pound & D. A. Saunders;* south of Albright, September 1, 1908, *F. G. Ernst.*

CASS COUNTY: Plattsmouth, woods of the Missouri river bluffs, May 15, 1886, no. 6127, *H. J. Webber.*

NEMEHA COUNTY: Nemeha, July 5, 1910, no. 5145, *Rev. J. M. Bates;* also reported from the vicinity of Peru by Bessey & Webber.

RICHARDSON COUNTY: wooded bluffs of the Missouri river, common, August 26, 1889, no. 6129, *H. J. Webber.*

Pawnee county: Table Rock, May, 1896, *J. E. Shue.*

Lancaster county: Lincoln, June 3, 1890, no. 6128, *H. J. Webber*, from Lucena Hardin; Lincoln, May, 1895, rich moist woods, *E. B. Robinson;* another specimen by Fred C. Cooley without further data.

University of Nebraska, Lincoln.

(To be continued)

The Soil Reactions of Certain Rock Ferns—I

Edgar T. Wherry

Judging from the literature, the ferns which grow on rocks would appear to be, on the whole, markedly sensitive to the chemical features of their soils. Their distribution is of course controlled to some extent by physical factors, such as climate, porosity of soil, availability of moisture, etc.; yet in many instances a given species has been observed to grow in soils of widely varying physical character, but consistently associated with a particular type of rock, and accordingly more or less uniform in chemical composition. Again, soils of like physical properties but dissimilar chemical nature often occur in such proximity that spores of the various ferns can not fail to have fallen into both kinds, yet flourishing plants have developed in but one of them.

It is commonly recognized that certain species of rock ferns grow by preference upon limestone and similar rocks, and are accordingly to be classed as calcareous soil plants. Other species, however, appear to avoid calcareous rocks quite definitely, and are presumably to be classed as acid soil plants. In the course of geological field trips and vacation outings for several years past the writer has been collecting information upon these

relationships. The first plan tried was to carry samples from the field to the laboratory, and there determine the percentage of calcium oxide (lime) present, both the total amount, and the soluble portion; and a brief account of some results thus obtained has been published.[1] Subsequently it has proved possible to work out a method for measuring, in the field, the soil reaction (acidity or alkalinity);[2] and as this is much simpler, as well as more instructive, than the determination of lime, an extensive series of such observations has been made, which it is the purpose of this paper to record.

The writer's field work on rock ferns has extended from Vermont and New Hampshire on the north to West Virginia and Virginia on the south, and all of the common species, as well as a few of the rarer ones, occurring within these limits have been studied. The results obtained are presented in table I, and subsequently discussed in detail. The correctness of previous classifications has been confirmed in most cases, but considerable new data have been obtained on many species. As pointed out in the above cited paper on rock ferns, it is the soil rather than the rock which affects the growth of plants; acid humus sometimes coats limestone ledges to such a thickness that species not normally favoring calcareous soils flourish there; and on the other hand, while the soils over sandstone, schist, granite, etc., are usually more or less acid in reaction, alkaline (calcareous) soils may accumulate on these rocks through the decomposition of vegetable debris, and typical calcareous soil species thrive there. Accordingly, actual tests have been made of the soils at the roots of the plants investigated. It is probable that further work will result in extending somewhat the ranges of reaction here recorded, although it seems unlikely that the classification of

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[1] American Fern Journal, 7, 110–112, 1917.

[2] To be published in Journ. Wash. Acad. Sci., April, 1920.

many of the species will be changed. It is hoped, in particular, that species which the writer has been unable to study fully will be worked up by others.

TABLE I. CLASSIFICATION OF ROCK FERNS ON THE BASIS OF SOIL REACTION

Name	No. of tests	Soil Reactions: Medacid 300+	Medacid 100	Subacid 30+	Circumneutral: Minimacid 10	Minimacid 3+	Minimalkaline 1	Minimalkaline 3+	Minimalkaline 10	Subalkaline 30+	Class
Cheilanthes lanosa	15	–	x	X	X	x	x	–	–	–	A
tomentosa	(2)	–	–	(x)	–	(x)	–	–	–	–	A
Pellaea atropurpurea	30	–	–	x	X	X	X	X	X	X	C
glabella	5	–	–	–	–	–	X	x	x	–	C
Cryptogramma Stelleri	15	–	–	–	–	x	X	X	X	–	C
Phyllitis Scolopendrium	(2)	–	–	–	–	–	(x)	–	–	–	C
Camptosorus rhizophyllus	50	–	–	x	X	X	X	X	X	X	C
Asplenium pinnatifidum	20	X	X	X	x	–	–	–	–	–	A
ebenoides	15(1)	–	–	x	X	x	x	x	x	x	C
platyneuron	50	–	x	X	X	X	X	X	X	x	C
resiliens	15	–	–	–	–	x	X	X	X	X	C
Trichomanes	30	–	–	x	X	X	X	X	X	X	C
viride	(2)	–	–	–	–	(x)	(x)	–	–	–	C
Bradleyi	5(3)	X	X	X	x	–	–	–	–	–	A
montanum	20	X	X	X	x	–	–	–	–	–	A
Ruta-muraria	15	–	–	–	–	x	X	X	X	X	C
Polypodium vulgare	50	–	x	X	X	X	X	X	X	x	C
polypodioides	15	X	X	X	X	x	x	–	–	–	A
Woodsia glabella	15	–	–	–	–	x	X	X	X	X	C
alpina	5	–	–	–	–	x	x	–	–	–	C
Ilvensis	25	–	x	X	X	x	–	–	–	–	A
obtusa	30	–	x	X	X	X	X	X	X	x	C
Filix bulbifera	30	–	–	x	X	X	X	X	X	x	C
fragilis	30	–	x	X	X	X	X	X	X	x	C
Dryopteris fragrans	(2)	–	–	–	(x)	–	–	–	–	–	C

Totals: Acid soil plants, 7; calcareous soil plants, 18; sum, 25.

EXPLANATION OF TABLE I

The names used are those accepted by most present-day writers; important synonyms are given in the subsequent discussion. The number of tests made on each

species is recorded, and, as about three tests have customarily been made at each locality, the number of localities represented is approximately ⅓ of the number of tests. Tests made on soil adhering to the roots of herbarium specimens, which seemed desirable in a few instances to supplement field data, are distinguished by parentheses.

The terms used for the soil reactions are those recently proposed;[3] the numbers are "specific acidities" and "specific alkalinities," and represent the amounts of acid or of alkaline constituents (ions) present, with reference to pure water as a unit. Thus the number 300 on the acid side means that the corresponding soil contains that many times as much acid as water contains, and so on. All reactions of soils in which the various species have been observed to grow are marked with a letter *x*, in lower case for rarely observed values, capitals for frequently observed ones, and bold face letters for what may be termed optimum values, that is those shown by the most luxuriant and flourishing plants.

The majority of the species tabulated clearly favor reactions lying toward one side of the table or the other, and it is convenient to have some way of classifying them on this basis. Those the dominant reactions of which lie toward the left hand side may be termed "acid soil plants." It should be noted that the degree of acidity represented by habitats supporting these ferns is for the most part less than that of the sphagnum bogs and sandy barrens where so-called "oxylophytes" grow, so the latter term is not desirable for application here. It is also noteworthy that the acid soil species are dominantly southern in distribution. This class is designated by an *A*, for acid, in the last column of the table.

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[3]Journ. Wash. Acad. Sci. 9, 305–309, 1919.

The complementary term "alkaline soil plants" is unsuitable for those showing dominant reactions toward the right hand side of the table, since the degree of alkalinity represented is at most but slight, and moreover no species of this class has been found which will not grow also in neutral and even slightly acid soils. The evidence indicates that the important factor in the case of plants avoiding the most acid soils is the relative abundance of calcium compounds, and accordingly "calcareous soil plants" will be used. The terms "calciphile" (lime lover) and "calcicole" (lime grower) are often applied to this class of plants. Since plants may grow in calcareous habitats for various other reasons than "love of lime" the latter term is the preferable one; but neither is really necessary. This class is marked in the table by a *C*, **for calcareous.**

It is evident from the table that no sharp line can be drawn between the two classes, as marked overlapping occurs in the central columns, especially in those of specific acidity 30, 10, and 3. Laboratory tests for calcium compounds have shown these to be present in practically all the soils concerned, their amount and especially their solubility diminishing markedly as the reactions approach mediacidity. By no means all species showing calcium compounds in their soils are calcareous soil plants; for when the specific acidity exceeds about 30 the physiological effect of the acid appears to predominate over that of the calcium; and although when the specific acidity is 10 or below, the effect of the calcium is dominant, some acid soil plants can still thrive even at the neutral point. In soils termed minimacid, plants of both classes may flourish side by side; but if enough occurrences of each species can be studied, the dominant reaction is always found to lie definitely toward one side or the other, and the plant can be assigned to the corresponding class.

FEATURES OF INDIVIDUAL SPECIES

Cheilanthes lanosa (vestita) is recorded in the literature as growing on sandstone, shale, schist, and trap rocks, and the writer has found it on the first three of these in Maryland, Virginia, and West Virginia. In these occurrences the soils have proved to be dominantly subacid to minimacid in reaction. In what appears to be the only recorded occurrence of this fern in a limestone region, that at Natural Bridge station, Virginia, it grows in clayey soil on a steep bank; and tests of this soil, for a specimen of which the writer is indebted to Mr. John P. Young of Washington, D. C., have shown it to be neutral, any free calcium carbonate which may have been present having been leached out by the rain. This fern is therefore regarded as an acid soil plant showing a considerable degree of tolerance for calcium compounds.

It seemed a matter of interest to ascertain if other species of the above genus showed similar soil requirements, but no opportunity to study any others in the field presented itself. Accordingly tests were made on the soil adhering to the roots of specimens of *Cheilanthes tomentosa* in the U. S. National Herbarium, for which privilege—as well as for other valuable assistance in the preparation of this paper—the writer is indebted to Mr. William R. Maxon. In specimens from Paint Rock, North Carolina, where the rock is presumably, as usual for this fern, sandstone, the reaction proved to be subacid. In one from Natural Bridge Station, the locality referred to in the preceding paragraph—the reaction was low minimacid. This species is therefore also classed provisionally as an acid soil plant tolerant of calcium.

Pellaea atropurpurea, as observed in Pennsylvania and adjoining states, is found not only on limestone, but also on apparently noncalcareous sandstone, schist, shale,

etc. The literature shows similar relations to exist in other regions. Tests have shown circumneutral reactions to be present in most cases, however, and in exceptional ones where the soil is low in calcium compounds and subacid in reaction, the plant is stunted and plainly not thriving. *Pellaea glabella*, which is recorded in the literature only on limestone, has been studied at two localities near Allentown, Pennsylvania, to which the writer was kindly guided by Mr. Harold W. Pretz. The soil in both places being made up of dolomitic limestone fragments, the reactions naturally proved to be more or less alkaline. Both species of *Pellaea* are thus to be regarded as typical calcareous soil plants, with, in the former case, a moderate tolerance for acid reactions.

Cryptogramma Stelleri (*Pellaea gracilis*) has been recorded most frequently on limestone, but also occasionally on sandstone, slate, and gneiss rocks. In Vermont it was found to be definitely limited to calcareous gneiss, the soils being more or less alkaline; but at Lincoln Falls, Sullivan County, Pennsylvania, a locality brought to the writer's attention by Dr. Everett G. Logue, of Williamsport, it grows in wet crumbly red sandstone. Such rocks sometimes yield strongly acid soils, but in this case tests of the soil into which the fern's roots extended showed the reaction to be neutral or at most slightly acid. The usual classification of this species as a calcareous soil plant practically intolerant of acid is therefore believed to be correct.

The writer has not had the opportunity to study *Phyllitis Scolopendrium* (*Scolopendrium vulgare*) in the field, but its soil reaction seemed to be of so much interest that tests were made on the soils of herbarium specimens, kindly furnished by Mr. Maxon. As the latter has pointed out in describing the distribution of this fern in America,[4] it grows in Tennessee in a stiff clay, forming a

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[4]Fernwort Papers, 30–46, 1900.

striking contrast to its soil at certain other stations, which is a black, friable leafmold. Both the clay from South Pittsburg, Tennessee and the leafmold from Jamesville, New York, yielded on testing practically neutral reactions, indicating the correctness of the usual classification of this fern as a calcareous soil plant. Although its distribution is of course largely controlled by climatic conditions, it is noteworthy that the results show it to grow in soils of divergent physical but uniform chemical character.

Camptosorus rhizophyllus (*Asplenium rhizophyllum*) has been found throughout Pennsylvania and adjoining states to be most frequent and luxuriant in circumneutral soils, although as noted in many places in the literature and emphasized in the writer's previous paper, the adjacent rock may vary widely. In occasional instances in which the soil was found to be subacid in reaction and low in calcium compounds the plant is, as a rule, stunted and weak-looking. Its usual classification as a calcareous soil plant may thus be accepted, although it is evidently fairly tolerant of acidity. It is interesting to compare with *Camptosorus* the related fern *Asplenium pinnatifidum*. The latter grows usually on sandstone, shale, schist, etc., and has apparently never been definitely reported on limestone or other calcareous rocks. A number of tests, made in Pennsylvania, Maryland, and Virginia, have shown its soils to contain some calcium compounds, but to be decidely acid in reaction. It is therefore to be classed as a typical acid soil plant, only slightly tolerant of calcium. The relations between these two ferns will be further discussed later on.

WASHINGTON, D. C.

(To be continued.)

The Woodsias of Quechee

CHARLES SMITH LEWIS

Three years ago, in the Gray Herbarium at Harvard, I found specimens of the W. *alpina* (Bolton) S. F. Gray labelled "Quechee Gulf, Vermont" and dated many years ago. The next year I found the same locality given in the Flora of Vermont (Bulletin No. 187 of the Vermont Agricultural Experiment Station), prepared by the Vermont Botanical Club; and I determined to get to Quechee. But it was not until August, 1919, that my son and I found ourselves standing on the station platform at Dewey's Mills, ready to hunt for the rarest of the Woodsias, the object of our desires for many years.

Quechee Gulf is a very narrow gorge, through which the Ottaquechee river reaches the lower levels and empties into the Connecticut. It is 160 feet from the top of the railroad bridge that spans the Gulf to the bottom. The gorge is not over half a mile in length. Its sides are very precipitous, the western wall impassable for a good deal of the distance; the eastern wall, while very steep and often quite perpendicular, does afford a possible foothold, and in the lower reaches a path runs along its base.

We entered at this lower end, under the directions given us by Mrs. H. E. Heselton of Taftsville, whose courtesy in helping us find some of the rarer Vermont ferns we shall always remember. Before long a cluster of small fronds up on the cliff caught our eyes and we clambered up the side of the gorge. It was steep, but that made no matter, for we both found plants of the W. *alpina*. Mine was growing in a patch of moss, and one plant was larger than any that I recollected in the herbariums, gathered from the United States. Full of enthusiasm we pushed up the Gulf. Soon we came

upon another spot where there were many plants, but most of them were small.

The trail led up over a ledge whose top overhung the water below. There we were rewarded by more discoveries. On the edge of the bank, above the rock, was a small station of the slender rock brake (*Cryptograma Stelleri* (Gmel.) Prantl). The fertile frond which we gathered was a very fine specimen.

Close by was a tuft of small green stalked fronds, which we quickly saw was *Woodsia glabella* R. Br. Just there it was almost abundant and way up near the top of the cliffs we found, later, another fine group of these delicate plants. Those that we found in the Gulf were much smaller than the W. *alpina*.

The time for our train was fast approaching so we clambered up the side of the Gulf, at this point quite accessible, and covered with hemlock and white birch trees. At the very top where the cliff was impassable and crumbling, overhanging the outcropping rock, was a large colony of the third of the Woodsias which we found that day, W. *ilvensis* (L.) R. Br. The fronds were not the commoner kind, erect, densely crowded and closely matted, such as we found in the pastures above the Gulf, but they were long and graceful as they hung down over the edge or along the sides of the rocks. They had however the distinctive characteristics of W. *ilvensis*, its chaffy rusty brown wool and the fine silvery hairs on the younger fronds.

As we left on the train Mrs. Heselton told us that *Pellaea atropurpurea* had been identified on the far side of the Gulf, high up out of reach. We did not see it, but we had the rare experience of finding the other rock brake, C. *Stelleri* and three of the four Woodsias which grow in the eastern United States. W. *obtusa* was not found in the immediate neighborhood, but Mts. Heselton writes me that it has been found by her growing

with fine specimens of *Asplenium platyneuron*, a little more than a mile west of Woodstock, that is, about eight miles west from Quechee, and Mr. J. G. Underwood reports it within about five miles.

Among the more common ferns we saw in the Gulf, were *Adiantum; Dryopteris marginalis; D. Thelypteris* and *D. intermedia; Athyrium angustum* (Willd.) Presl and possibly the variety *elatius*. *Cystopteris bulbifera* grew in profusion all along the lower sides of the cliffs and we found a few fronds of *C. fragilis* in the Gulf and also in the pastures above it. *Polypodium vulgare* was abundant in places, and we saw two of the Osmundas, *O. regalis* at the very water's edge, with *O. cinnamomea* not far away. Up in the pasture we found not only the fragile bladder fern but *W. ilvensis*, *Dicksonia punctilobula* and *Pteris aquilina*. Along the railway just beyond Dewey's as we were going off we saw *Onoclea sensibilis* and *O. Struthiopteris*. Most of these ferns are abundant in the district. But we doubt if in many other places the three rarer Woodsias can be found in so small a radius, and if in any other place so far south and at so low an elevation one can find such a station of *Woodsia alpina*.

BURLINGTON, N. J.

Recent Fern Literature

Dr. J. H. Barnhart has published an interesting account of an American writer on ferns who is little known to most of us—William Brackenridge.[1] Brackenridge's own modesty and retiring disposition has made biographical material in regard to him difficult to obtain, but Dr. Barnhart has been able to put together a fairly complete narrative of his life.

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[1] Barnhart, J. H. Brackenridge and his book on ferns. Journ. N. Y. Bot. Garden **20**: 117–124. June, 1919.

He was one of the honorable company of gardeners who have proved themselves also good botanists. Born at Ayr, Scotland, June 16, 1810, he came to this country in 1837 and entered the employ of a Philadelphia nurseryman. The next year he received an appointment as horticulturist and assistant botanist of the United States Exploring Expedition under command of Captain Wilkes and sailed with it in August, 1838. The expedition spent three and a half years in explorations in South America, the islands of the Pacific Ocean and the then little known coasts of California and Oregon, returning in June, 1842. It brought back some ten thousand specimens of dried plants, 100 living ones and many seeds.

The organization of the expedition was continued in order to work up its scientific results. Brackenridge was put in charge of growing the plants brought home and raised from seed and in this work he continued until 1854, when the organization was broken up. To him also was assigned the duty of reporting on the ferns collected. There have been few authors more unfortunate than was Brackenridge with this, his one botanical work. His initial difficulty—that he knew no Latin—was overcome with the aid of Professors Torrey and Gray, who translated his descriptions into that language, and the work was duly issued in 1854, only to have the greater part of the edition destroyed by two nearly simultaneous fires, one in Washington, and one at the printers' in Philadelphia. As a result, complete copies of this Report—an excellent piece of work—are rare.

After leaving the Government service, Brackenridge established himself as a nurseryman and landscape architect near Baltimore and there remained until his death, February 3, 1893.

SOME VIRGINIA FERNS—On November 24, 1919, at Natural Bridge, Va., I found two plants of *Asplenium ebenoides* R. R. Scott. This fern had previously been reported from this station. *Camptosorus rhizophyllus* (L.) Link was ridiculously common and there was plenty of *Asplenium parvulum* Mart. & Gal.

At Lynchburg, Va., on November 23, large, vigorous specimens of *Cheilanthes lanosa* (Michx.) Watt were readily obtained.—JOHN P. YOUNG, Washington, D. C.

SOME UNOFFICIAL FERN LORE—According to a little book on "the sentiment of flowers, or language of Flora," adapted from the French of Madame de la Tour and published at Philadelphia in 1840, the "Fern" is the emblem of sincerity. This will seem appropriate enough to any fern-lover; but note the reason for it: "Fern often affords an agreeable seat to lovers; its ashes are used in the manufacture of glasses for the convivial party; and all the world knows that love and wine make men sincere!"

As the reference to its use in the manufacture of glass shows, the fern here meant is the European bracken. Two other ferns appear in the book. The maiden hair (*Adiantum Capillus-Veneris?*) is the emblem of discretion or secrecy because "botanists have in vain sought to find out the nature of this plant, which seems determined to conceal from their learned researches the secret of its flowers and its fruit. It confides to zephyrs alone the invisible germs of its young family." The flowering fern (*Osmunda regalis*) symbolizes reverie and we are told that Mathiole attributes to it "the virtue of inspiring prophetic dreams."

A bit of fern folk-lore, which has found its way into so serious and respectable a work as Mrs. Lincoln's Botany, is this: "One species in our country, *Onoclea*

sensibilis, called the sensitive fern, is said to wither on being touched by the human hand, though the touch of other substances does not produce any similar appearances."

American Fern Society

Members of the Society will hardly need to be reminded that Carl Christensen's *Index Filicum* is indispensable to students of fern classification and useful in any line of fern study. Having noted an inquiry for this work in the JOURNAL, Mr. Christensen now offers copies of it, including the Supplement, to members of the Fern Society only, for ten dollars each. This is the actual cost of the books to him. He makes only one condition –that the Society act as his agent in receiving orders and collecting payment—and asks that all orders, if possible, be sent to him at one time, in order to save trouble and expense in shipping.

Members wishing to take advantage of this generous offer should send their orders, with remittance, to the Secretary, Mr. S. H. Burnham, R. D. 2, Hudson Falls, N. Y. Deliveries will be made as soon as the books can be got from Denmark. Purchasers will be expected to pay postal charges from Hudson Falls to their places of residence.

ANNUAL REPORTS OF THE SOCIETY

Reports of officers received up to the time of going to press are printed below. The President's report is deferred until the next number in order to treat more fully the financial situation which the Society has to face owing to the greatly increased cost of publishing the JOURNAL. The Treasurer's report is also, through no fault of his, delayed.

Report of the Secretary for 1919

The past year for the Society has been a quiet one. No meetings have been held or special activities undertaken.

A few gifts have been received by the Society. Mrs. Judith H. Coffin, a short time before her death, donated vols. 13 to 18 of the *Fern Bulletin* and vols. 1 to 7 of the AMERICAN FERN JOURNAL. Dr. R. C. Benedict presented a number of copies of reprints of articles by him for distribution to the members. Mr. C. H. Knowlton gave the manuscript of Mr. Raynal Dodge's letter giving a detailed account of the discovery of *Aspidium simulatum* and *Aspidium cristatum*×*marginale*.

Mr. E. W. Graves distributed a few specimens of *Botrychium alabamense* and *B. biternatum* from Alabama, among the members.

Six members have died: Mrs. Judith Hopkins Coffin, Amedée Joseph Hans, Kenneth Bradford Laird, in Federal Service, Miss Lura L. Perrine, Mrs. Kelton E. White (née Miss Blanche A. Turner), and Miss Mary Louise Utley.

Four members have resigned. Thirteen have been dropped for non-payment of dues, already two years in arrears: among these the present addresses of Miss Margaret Slosson and Rev. H. G. Limric are unknown. Sixteen new members have been received and the membership (December 31, 1919) stands at 258, a loss of seven over last year. Mr. Leston A. Wheeler has changed from an ordinary to a life member.

The readjustment and increased cost of living, after the war, has probably had much to do with the loss in membership. If 50 new members could be added next year it would both enlarge the field of influence of the Society and place it on a more permanent basis. Let each member at least attempt to influence one of

his friends to join the Society; for we must all coöperate to increase the membership. The Secretary is very grateful to his predecessor, Mr. Weatherby, for his uniform courtesy and kindness on many occasions.

S. H. BURNHAM, *Secretary*

Report of the Curator for 1919

For the past year the work of the curator has been largely of a routine nature, consisting for the most part in mounting and cataloguing additional material. 275 sheets have been mounted from the collection of specimens from the Philippines and British North Borneo mentioned in as a previous report having been contributed by Mr. D. LeRoy Topping; Dr. O. E. Jennings has contributed 37 additional sheets from his Ontario collections; Mr. C. A. Weatherby has donated 15 sheets; J. B. Flett, 18; J. C. Nelson, 1; L. S. Hopkins, 10; and Geo. L. Moxley, 24—a total of 380 sheets. The contributions just named have all been mounted and incorporated into the herbarium which now numbers 3381 mounted sheets with probably 200 additional sheets of unidentified specimens which are as yet unmounted.

Mr. Topping's collection was especially noteworthy in that it contained cotypes of 11 species as follows: *Nephrolepis marginalis* Copel., *Mesochlaena Toppingi* Copel., *Dryopteris Kinabauensis* Copel., *Dryopteris lithophylla* Copel., *Dryopteris Toppingii* Copel., *Cyathea megalosora* Copel., *Cyathea rigida* Copel., *Cyathea Toppingii* Copel., *Polypodium multisorum* Copel., *Polypodium albidopaleatum* Copel., and *Polypodium brachypodium* Copel.

Preparation of the Ms. for a new catalogue of the herbarium is progressing slowly as attention can be

given it only when time permits. However it is hoped to have the Ms. ready for the printer before a great while. L. S. HOPKINS, *Curator*

Report of the Editors for 1919

The JOURNAL has been fortunate during the past year in the matter of illustrations. Mrs. William F. Brooks and Prof. Hopkins have each given one plate and Mr. E. H. Clarkson two. Prof. Hopkins has also made photographs especially for two others. Another member who wishes to remain anonymous has set the commendable example of adding to his dues each year a dollar to be used for pictures. The total of his contributions has now more than paid for a full-page plate.

Probably as an after-effect of the war, copy has come in slowly and scantily and all four numbers have been late in consequence. We can now report an improvement in that respect; we have advance copy enough for more than two numbers (including the present one) on hand. It includes two new state fern floras (of Alabama and Nebraska) and an exceptionally interesting article on a new line of work—the investigation, by easily made chemical tests, of the soil preferences of our ferns.

During the coming year we shall have to decide how best to deal with the large increase in cost of publication. This matter, affecting the whole Society, will later be laid before the members in detail. Meanwhile, we may say that requests for sample copies were never so numerous as during the last few weeks. If we can take advantage of this revival of interest to secure a substantial increase in the Society's membership, our financial problem will be solved in the best possible

way. A little personal work by each member would go far toward doing it.

R. C. BENEDICT,
E. J. WINSLOW,
C. A. WEATHERBY,
Editors

Our readers will notice that there is no illustration in this number. In order to keep current expenses within the estimated income for the year, the Council, in making up the budget for 1920, have thought best to omit the usual appropriation for illustrations in the JOURNAL. This does not mean, however, that there will be no more. Some small additional funds will be available for illustrations, and we hope for occasional gifts. Contributors who have suitable pictures are asked to send them in as heretofore.

New members:

Bean, Ralph C., 48 Emerson St., Wakefield, Mass.
Briggs, T. Lynton, 188 Central Ave., Flushing, N. Y.
Logue, Dr. Everett G., 1601 Almond St., Williamsport, Pa.
Young, John P., 1730 Massachusetts Ave., Washington, D. C.

Changes of address:

Higgins, D. F., 336 Fifth Ave., Joliet, Ill.
Steil, W. N., 1806 Chadbourne Ave., Madison, Wis.

WANTED—Herbarium specimens of *Dryopteris oreopteris* (Ehrh.) Max., *Polystichum Lemmoni* Underw., *Polystichum scopulinum* (Eat.) Max., *Phegopteris alpestris* (Hoppe) Mett., and *Cystopteris montana* (Lam). Bernh. Can give specimens from the S. E. United States and Cuba in exchange, or will pay cash for them —E. W. GRAVES, *Bentonsport, Ia.*

American Fern Journal

Vol. 10 APRIL–JUNE, 1920 No. 2.

The Fern Flora of Nebraska—II

T. J. FITZPATRICK

ATHYRIUM FILIX-FOEMINA (L.) Roth. (*Asplenium filix-foemina* (L.) Bernh.) Lady fern.

Woods and thickets, frequent only in favorable places but not found in most portions of the state. A widely variable species and widely distributed, ranging generally throughout North America, also found in Europe and Asia.

BROWN COUNTY: Long Pine, Seven Springs, July, 1892, no. 441, *Albert F. Woods;* Long Pine, September, 1893, no. 2938, *Fred Clements.*

DOUGLAS COUNTY: Omaha, from garden, from a plant gotten from 2569 Pierce St., July 27, 1901; also September 16, 1901, and September 2, 1902, *William Cleburne.*

LANCASTER COUNTY: Lincoln, July, 1886, no. 6122, *H. J. Webber*, a poor and fragmentary specimen but clearly this species. It is labeled *Asplenium thelypteroides* Michx.

CHEILANTHES FEEI Moore. (*Cheilanthes lanuginosa* Nutt.) Lip fern.

Known only from the extreme western and southwestern parts of the state; occurs on exposed rocks.

BANNER COUNTY: exposed rocks of a cañon, one mile southwest from Hackberry Springs, August, 1890, *P. A. Rydberg;* August 8, 1891, no. 479, *P. A. Rydberg.*

REDWILLOW COUNTY: reported by C. E. Bessey.

[Vol. 10, No. 1 of the JOURNAL, pages 1-32, was issued April 21, 1920.]

CRYPTOGRAMMA ACROSTICHOIDES R. Br. Rock-brake.

Rocky places, rare, known only from one locality.

FRANKLIN COUNTY: Franklin. 1893. *E. M. Hussong.* A single fruiting blade sent to Dr. C. E. Bessey for determination. The locality is somewhat outside of the known range of the species but the specimen seems properly referred.

CYSTOPTERIS FRAGILIS (L.) Bernh. (*Filix fragilis* (L.) Under.) Brittle fern.

This species is found in rich woods, along wooded banks of streams, and in cañons, and is rather common in most portions of the state. It is the most abundant fern of Nebraska.

DIXON COUNTY: Ponca, bluffs of the Missouri river, June 15, 1893, no. 2556, *Fred Clements.*

DOUGLAS COUNTY: Omaha, April, 1889, no. 6118, *H. J. Webber.*

CASS COUNTY: Plattsmouth, shaded ravines, Missouri river bluffs, May 15, 1886, no. 6117, *H. J. Webber;* also reported from the vicinity of Weeping Water by Bessey & Webber. There is an immature specimen from Weeping Water, collected in moist rocky places, May 14, 1892, by *Emma Stover.*

OTOE COUNTY: Nebraska City, June 1, 1889, no. 6115, *H. J. Webber.*

SAUNDERS COUNTY: Ashland, June 24, 1890, *Tom A. Williams.*

NEMAHA COUNTY: Nemaha, July 5, 1910, no. 5140, *Rev. J. M. Bates;* also reported from the vicinity of Peru by Bessey & Webber.

JOHNSON COUNTY: Tecumseh, *Anna Pinnel.*

JEFFERSON COUNTY: Endicott, Republican valley, August 23, 1893, no. 2002, *A. F. Woods & DeAlton Saunders.*

LANCASTER COUNTY: Lincoln, damp wooded banks, June 3, 1890, no. 6120. *H. J. Webber* from Lucena Hardin;

old sandstone quarry, June, 1886, *J. G. Smith;* on banks of Antelope creek, opposite H Street, May 20, 1886, *T. Walton;* Lincoln, shaded cliffs, May, 1895, *C. B. Robinson.*

SEWARD COUNTY: Milford, May, 1886, no. 6116. *H. J. Webber.*

CUSTER COUNTY: Anselmo, wooded bluffs, July 8, 1889, no. 6121, *H. J. Webber.*

THOMAS COUNTY: near Plummer ford, shaded banks of Dismal river, July 3, 1893, no. 1452, *P. A. Rydberg;* Halsey, June 24, 1912, *Raymond J. Pool & Donald Folsom.*

ANTELOPE COUNTY: on Verdigris creek, near Royal, 1908, *N. F. Peterson.*

BROWN COUNTY: Long Pine, cañons, July 23, 1887, *C. E. Bessey;* Long Pine, Seven Springs, July, 1892, no. 439, *Albert F. Woods;* Long Pine July 29, 1892, no. 270, *J. G. Smith & Roscoe Pound.*

DAWES COUNTY: Belmont, wooded bluffs, July 18, 1889, no 6119, *H. J. Webber.*

SIOUX COUNTY: Squaw cañon, August, 1892, no. 439, *Albert F. Woods;* Monroe cañon, north of Harrison, June 22, 1911, *Raymond J. Pool & C. V. Williams.*

DRYOPTERIS CRISTATA (L.) A. Gray. (*Aspidium cristatum* (L.) Swartz). Crested shield fern.

This species is known only from one locality in the state.

THOMAS COUNTY: central Nebraska, on south fork of Dismal river, on wet meadows, August 14, 1893, no. 1530, *P. A. Rydberg.*

DRYOPTERIS SPINULOSA (Muell.) Kuntze. (*Aspidium spinulosum* (Muell.) Swartz). Spinulose shield fern.

Rarely found in Nebraska and known from only two localities.

THOMAS COUNTY: damp shaded banks, near water's edge, Dismal river, July 12, 1889, nos. 6126, 6125, 6127, *H. J. Webber;* near Plummer ford, Dismal river, in damp woods, July 4, 1893, no. 1484, *P. A. Rydberg.*

BROWN COUNTY: Long Pine, June 25, 1892, *Rev. J. M. Bates;* September 4, 1893, no. 2939, *Fred Clements.*

DRYOPTERIS THELYPTERIS (L.) A. Gray. (*Aspidium thelypteris* (L.) Swartz). Marsh shield-fern.

This species is common in most portions of the state. It occurs in moist shady places and grassy wet bottoms, often associated with *Onoclea sensibilis* and forming with it a fern meadow.

JEFFERSON COUNTY: Endicott, Republican valley, August 23, 1893, no. 2004, *A. F. Woods & DeAlton Saunders.*

FRANKLIN COUNTY: in prairie hay cut in the Republican valley, near Franklin, May 5, 1896, no. 6777, *E. M. Hussong.*

KEARNEY COUNTY: marsh near Platte river, June 15, 1891, no. 478, *P. A. Rydberg;* Newark, July, 1892, *Dr. H. Hapeman.*

BUFFALO COUNTY: Kearney, 1887, *G. A. Beecher;* August, 1893, *Misses Smith & Lee.*

THOMAS COUNTY: wet bottoms, Loup river, July 11, 1889, no. 6123, *H. J. Webber;* wet bottoms, Dismal river, July 12, 1889, no. 6124, *H. J. Webber;* on south fork of Dismal river, in wet meadow, August 14, 1893, no. 1684, *P. A. Rydberg;* Halsey, July, 1911, *R. J. Pool;* also reported from the vicinity of Thedford by Bessey & Webber.

DODGE COUNTY: Fremont, August 9, 1872, *C. E. Bessey.*

BROWN COUNTY: Long Pine, July 23, 1887, *C. E. Bessey;* Long Pine, Seven Springs, July, 1892, no. 443, *Albert F. Woods;* Long Pine, September 2, 1893, no. 2936, *Fred Clements.*

CHERRY COUNTY: July 19, 1892, no. 278, *J. G. Smith & Roscoe Pound.*

DAWES COUNTY: reported from the vicinity of Crawford by Bessey & Webber.

NOTHOLAENA DEALBATA (Pursh) Kuntze. (*Notholaena nivea dealbata* (Pursh) Davenport).

This species reaches its northern limit in Nebraska, ranging from Nebraska and Missouri to Texas and Arizona. Known in Nebraska only from a single locality.

CASS COUNTY: Weeping Water, growing from crevices in rocks, August 22, 1888, no. 6112, *H. J. Webber;* dry rocks, August 22, 1888, *Tom A. Williams;* November 11, 1895, no. 6773, *T. A. Williams.*

ONOCLEA SENSIBILIS L. Sensitive fern.

Frequent or common in low wet soil, often in grassy places, in some localities becoming a weed; ranges generally throughout the state.

OTOE COUNTY: Nebraska City, March, 1904, *Cooper Dunn*, a weather beaten fragment of the preceding year's growth.

JEFFERSON COUNTY: Fairbury, southern Nebraska, September 1, 1892, no. 7270, *Ruth A. Price;* Endicott, Republican valley, August 23, 1893, no. 2003, *A. F. Woods & DeAlton Saunders.*

BUFFALO COUNTY: Kearney, August, 1893, no. 7703; along the Platte river, 1894, both by *Misses Smith & Lee;* Kearney, no. 6111, *H. J. Webber.*

FRANKLIN COUNTY: in prairie hay cut in the Republican valley near Franklin, May 5, 1896, no. 6775, *E. M. Hussong.*

THOMAS COUNTY: in woods near Plummer ford, Dismal river, August 23, 1893, no. 1377, *P. A. Rydberg;* low prairies, very common, Dismal river, July 12, 1889, no. 6110, *H. J. Webber;* Halsey, July, 1911, *R. J. Pool.*

ANTELOPE COUNTY: reported by Bessey & Webber.

HOLT COUNTY: Paddock, July 29, 1893, no. 2802, *Fred Clements.*

BROWN COUNTY: Long Pine, June 25, 1892, *Rev. J. M. Bates*, an unusual specimen with the tips of the lobes coarsely crenately toothed or incised and fluted; Long Pine, July, 1892, no. 442, *Albert F. Woods:* Long Pine, August 25, 1908, *Rev. J. M. Bates.*

CHERRY COUNTY: July 19, 1892, no. 277, *J. G. Smith & Roscoe Pound;* also a specimen collected twenty miles southwest of Valentine, no further data.

PELLAEA ATROPURPUREA (L.) Link. Cliff brake.

In localities where it is found this species is frequent in crevices of rocks; in Nebraska found only in the southeastern portion.

CASS COUNTY: Weeping Water, dry calcareous rocks, May 23, 1887, no. 6108, *H. J. Webber;* April 19, 1919, *R. J. Pool.*

NEMAHA COUNTY: Brownville, January 2, 1889, no. 6109, *H. J. Webber;* reported from the vicinity of Peru by Bessey & Webber.

JEFFERSON COUNTY: Endicott, July 17, 1892, *Miss Case;* August 23, 1893, no. 2001, *A. F. Woods & DeAlton Saunders.*

WOODSIA OBTUSA (Spreng.) Torrey.

This species seems to be limited mostly to the southeastern portion of the state, rarely found in the central and western portions. Found in crevices of rock cliffs.

PAWNEE COUNTY: Pawnee City, 1892, *C. H. Barnard.*

LANCASTER COUNTY: Emerald, December 7, 1895, no. 6774, *A. S. Hunter.*

CUSTER COUNTY: Callaway, July 3, 1902, no. 2370, *Rev. J. M. Bates.*

BROWN COUNTY: Long Pine, reported by Bessey & Webber.

WOODSIA OREGANA D. C. Eaton.

This species apparently is confined to the western half of the state; it is frequent on dry open bluffs.

THOMAS COUNTY: dry banks, Dismal river, July 12, 1889, no. 6106, *H. J. Webber;* on hillside near Plummer ford, Dismal river, July 3, 1893, no. 1479, *P. A. Rydberg.*

BROWN COUNTY: Long Pine, collected by *J. Conklin*, no. 8 ex-herbarium G. D. Swezey; Long Pine, cañons, July 23, 1887, *C. E. Bessey.*

DAWES COUNTY: Belmont, dry banks, July 18, 1889, no. 6105, *H. J. Webber.*

SIOUX COUNTY: on buttes, August, 1892, no. 440, *Albert F. Woods;* Hat Creek, June 24, 1890, *Tom A. Williams.*

MARSILEACEAE

MARSILEA VESTITA Hook. & Grev. Hairy pepperwort.

In ponds, frequent in many places in the state. During periods of drought terrestrial specimens may be found having hairy and narrow leaflets and these have been named the variety *tenuifolia* Und. & Cook.

JEFFERSON COUNTY: Meridian township, section 22, 1891, *E. F. Lange;* Fairbury, September 3, 1892, *E. F. Lange.*

FILLMORE COUNTY: Fairmont, August, 1890, and August 4, 1891, *J. H. Haughaugout;* August, 1890, no. 6113, labeled var. *tenuifolia* Und. & Cook, *H. J. Webber;* ponds, August 1, 1890, *J. H Haughaugout*, labeled var. *tenuifolia* Und. & Cook.

WEBSTER COUNTY: Red Cloud, *Rev. J. M. Bates.*

KEARNEY COUNTY: Minden, August 13, 1891, *Dr. H. Hapeman*, labeled var. *tenuifolia*; prairies and sandhills of central Nebraska, July 13, 1900, altitude 500 meters, no. 6604, *P. A. Rydberg.*

DEUEL COUNTY: July 3, 1893, *E. M. Gilliard.*

BOX BUTTE COUNTY: July 7, 1892, no. 275, *J. G. Smith & Roscoe Pound.*

PIERCE COUNTY: Plainview, July 2. 1907, in shallow ponds, *N. F. Petersen.*

ANTELOPE COUNTY: Clearwater, June 16. 1899, reported as a weed, no. 12036, *D. M. Decamp;* Brunswick, June, 1909, *N. F. Petersen.*

SALVINIACEAE

AZOLLA CAROLINIANA Willd.

Apparently known from only one or two localities, rare.

THOMAS COUNTY: on ground at edge of water, Dismal river, July 12, 1889, no. 6101. *H. J. Webber;* in a spring near Plummer ford, Dismal river, August 24, 1893, *P. A. Rydberg.*

GARDEN COUNTY: Dr. R. J. Pool reports finding this species in great abundance along Blue creek in May. 1912.

EQUISETACEAE

EQUISETUM ARVENSE L.

Common in sandy soil, fields, pastures, waste places, roadsides. The simple fertile stems appearing in March and April and soon withering after fruiting, the branched sterile stems come later and persist throughout the summer. This species seems to appear mostly as a weed and will be found in low wet grounds to rather high and dry situations.

SARPY COUNTY: Bellevue, May 13, 1893, no. 4097, *Roscoe Pound & DeAlton Saunders.*

SAUNDERS COUNTY: Ashland, June 24, 1890, *Tom A. Williams*

CASS COUNTY: Weeping Water, reported by Bessey & Webber.

OTOE COUNTY: Nebraska City, May 28, 1893, no. 4067, *Roscoe Pound & F. E. Clements.*

NEMAHA COUNTY: Brownville, reported by Bessey & Webber.

GAGE COUNTY: Wymore, reported by Bessey & Webber.

LANCASTER COUNTY: Lincoln, May, 1890, May 2, 1893, no. 3230, *Pound, Clements & Saunders;* also a specimen without definite data by *A. F. Woods*, and a similar one by *Fred C. Cooley.*

SEWARD COUNTY: Milford, low wet ground, May 23, 1886, no. 6138, *H. J. Webber.*

CUSTER COUNTY: Anselmo, reported by Bessey & Webber.

THOMAS COUNTY: near Thedford, in meadow on Middle Loup river, September 9, 1893, no. 1378, *P. A. Rydberg;* on wet meadow near Nattick, June 20, 1893, no. 1378, *P. A. Rydberg.*

BROWN COUNTY: Long Pine, reported by Bessey & Webber.

DAWES COUNTY: near Pine Ridge, July 24, 1889, *H. J. Webber.*

SIOUX COUNTY: Squaw cañon, August, 1892, no. 447, *Albert F. Woods;* Hat creek basin, August 1, 1889, no. 6133, *H. J. Webber.*

EQUISETUM FLUVIATILE L. (*E. limosum* L.)

This species apparently is infrequent in Nebraska. It occurs in swampy places and along borders of streams and ponds.

KEARNEY COUNTY: Platte river, June 15, 1891, no. 475, *P. A. Rydberg.*

GARFIELD COUNTY: Burwell, July 22, 1909, no. 4917, *Rev. J. M. Bates.*

HOLT COUNTY: southwest part, along Holt creek, August 2, 1892, *Rev. J. M. Bates.*

BROWN COUNTY: Long Pine, August 3, 1909, no. 4933, *Rev. J. M. Bates.*

EQUISETUM LAEVIGATUM A. Braun.

Common in moist soil in low fields, pastures, and waste places.

DIXON COUNTY: Ponca, June 14, 1893, no. 2542, *Fred Clements*

CASS COUNTY: Weeping Water, reported by Bessey & Webber.

LANCASTER COUNTY: Lincoln, prairie bank of Antelope, northeast of town, May 8, 1885, no. 6139, *H. J. Webber;* marshy prairie, Lincoln, April, 1886, *J. G. Smith;* marshy grounds, Lincoln, May, 1886, *J. G. Smith.*

SALINE COUNTY: Crete, reported by Bessey & Webber.

JEFFERSON COUNTY: Fairbury, low land near water, May 31, 1886, no. 32.

WEBSTER COUNTY: Red Cloud, June 2, 1908, no. 4509, *Rev. J. M. Bates.*

KEARNEY COUNTY: wet prairie, June 15, 1891, no. 476, *P. A. Rydberg.*

DUNDY COUNTY: Benkelman, August 5, 1893, no. 2000, *A. F. Woods & DeAlton Saunders.*

CUSTER COUNTY: Callaway, May 28, 1902, no. 2225, *Rev. J. M. Bates.*

THOMAS COUNTY: in wet meadow on Middle Loup river near Thedford, June 14, 1893, nos. 1260 & 1283, *P. A. Rydberg;* Thedford, July 11 & 14, 1889, nos. 6136 & 6131, *H. J. Webber;* Halsey, July, 1911, *R. J. Pool.*

GARDEN COUNTY: Oshkosh, June 6, 1912, *Raymond J. Pool.*

BROWN COUNTY: Long Pine, reported by Bessey & Webber.

SHERIDAN COUNTY: July 9, 1892, no. 276, *J. G. Smith & Roscoe Pound.*

DAWES COUNTY: Pine Ridge, July 24, 1889, no. 6130, *H. J. Webber.*

SIOUX COUNTY: Squaw cañon, August, 1892, no. 445, *Albert F. Woods;* Hat Creek basin, August 2, 1889, *H. J. Webber.*

There are also two sheets collected by Samuel Aughey, about 1875, without definite data.

EQUISETUM ROBUSTUM A. Braun.

This species is quite common along river banks throughout the state.

DIXON COUNTY: Ponca, June 14, 1893, no. 2543, *Fred Clements.*

SARPY COUNTY: Bellevue, September 3, 1893, no. 3189, *Roscoe Pound & D. A. Saunders.*

CASS COUNTY: South Bend, *Mr. Kemble,* no further data.

NEMAHA COUNTY: Missouri river bottoms, Brownville, January 2, 1889, nos. 6132 & 6140, *H. J. Webber,* specimens with branches.

KEARNEY COUNTY: along Platte river, June 15, 1891, no. 475, *P. A. Rydberg.*

BUFFALO COUNTY: Kearney, banks of the Platte river, July 20, 1901, no. 54, *J. J. Thornber.*

THOMAS COUNTY: on hillside near Plummer ford, Dismal river, August 24, 1893, no. 1722, *P. A. Rydberg;* Thedford, July 10, 1889, no. 6135, *H. J. Webber.*

CHERRY COUNTY: Fort Niobrara, August, 1890, no. 38, *Rev. J. M. Bates.* This fragmentary specimen is labeled *Equisetum hyemale* L. and it was published as such by *Dr. C. E. Bessey.*

DAWES COUNTY: Pine Ridge, July 14, 1889, no. 6134, and July 24, 1889, no. 6137, *H. J. Webber.*

SIOUX COUNTY: Squaw cañon, August, 1892, no. 446, *Albert F. Woods;* Monroe cañon, north of Harrison, June 18, 1911, *Raymond J. Pool & C. V. Williams.*

EQUISETUM VARIEGATUM Schleich.

This species seems to be infrequent or rare; it occurs usually in wet soil.

LANCASTER COUNTY: Lincoln, Antelope creek, May, 1887, *J. R. Schofield.*

KEARNEY COUNTY: wet prairies, June 13, 1891, no. 477, *P. A. Rydberg.*

HOOKER COUNTY: on wet meadow near Middle Loup river, July 17, 1893, no. 1801, *P. A. Rydberg.*

BROWN COUNTY: Long Pine, reported by Bessey & Webber.

CHERRY COUNTY: Valentine, July, 1891, no. 39, *Rev. J. M. Bates.*

SELAGINELLACEAE

SELAGINELLA RUPESTRIS (L.) Spring.

Dry rocky soil or cliffs, infrequent or rare, apparently confined to certain localities, sometimes locally frequent.

BROWN COUNTY: sandhills, Long Pine, July 23, 1887, also 1890, *C. E. Bessey;* July 28, 1892, no. 271, *J. G. Smith & Roscoe Pound.*

ANTELOPE COUNTY: near Royal, August 7, 1907, *N. F. Petersen.*

LINCOLN COUNTY: reported by Bessey & Webber.

CHEYENNE county: reported by Bessey & Webber.

ISOETACEAE

ISOETES MELANOPODA J. Gay.

Known in Nebraska from one locality in the southeastern portion, rarely collected.

FILLMORE COUNTY: northeastern part of the county, roadside ditches on road north from Exeter, about one half mile from the depot, September 8, 1888, *Dr. J. Herman Wibbe.*

UNIVERSITY OF NEBRASKA, LINCOLN.

The Soil Reactions of certain Rock Ferns—II

EDGAR T. WHERRY

Asplenium ebenoides appears to have been found most frequently on limestone, although its type locality was on gneiss or schist, and at the famous occurrence at Havana, Alabama, the rock is described as a conglomerate. At several stations located by Messrs. Pretz and Young near Allentown, Pennsylvania, and Natural Bridge, Virginia, respectively, the rocks are limestone, and the soil reactions alkaline or, where the fern grows in moss coating the rocks, slightly acid. Near Harper's Ferry, West Virginia, a plant kindly shown to the writer by Dr. T. C. Stotler grows on shale, and the soil is minimacid. The soils in the pockets in schist rock, where this species has been found along the Potomac northwest of Washington, are likewise moderately acid. The soil on herbarium specimens collected by Mr. Maxon at Havana was found to have a high minimacid reaction. This fern is therefore inferred to be a calcareous soil plant, somewhat tolerant of acid conditions.

Asplenium platyneuron (*ebeneum*) grows with apparently equal frequence in both moderately acid and alkaline soils, the statement sometimes made that it prefers limestone coming apparently from the lack of appreciation of its abundance and luxuriance in many regions where there occur no limestone or other calcareous rocks whatever. It is interesting to note, however, that this fern tends to avoid soils of greater acidity than subacid, and when growing in regions of dominant mediacid soils, as in the Pine-Barrens of New Jersey, it is most often found on steep banks where soils of subacid reaction are developed. In southern Delaware it occurs in isolated patches in pine woods, and tests have shown the soils of these areas to be distinctly less acid than are those of the

region in general, due either to locally more complete decomposition of the vegetable matter, or to the presence of more or less calcareous lenses in the underlying sand formation. These facts, together with its occurrence on limestone rocks, lead to its classification as a calcareous soil plant tolerant of acidity to a considerable but not an extreme degree.

Asplenium resiliens (*parvulum*) has been recorded more often on limestone than on other rocks, and several observations upon it, in southern Virginia, confirm the correctness of its usual classification as a calcareous soil plant practically intolerant of acid conditions. It is usually rooted in limestone fragments of alkaline reaction, and even in occurrences in mossy humus the acidity was not observed to exceed low minimacid values. The more widespread *Asplenium Trichomanes*, observed throughout the region studied, is well known to occur on all sorts of rocks. On limestone it often grows in the open, in soil composed of rock fragments and accordingly alkaline in reaction. On sandstone, schist, gneiss, etc., it usually grows, however, in soils made up of decomposed vegetable matter accumulated in places more or less sheltered from the action of the rain, so that little lime can be leached out, and the reaction is circumneutral or rarely subacid. It is thus to be considered a calcareous soil plant moderately tolerant of acidity.

The writer has been unable to study *Asplenium viride* in the field, as his visit to the region of Willoughby Lake, Vermont, was too brief to permit a climb to its recorded place of growth near the top of the cliffs of Mt. Hor. The rock of this mountain is, however, a calcareous gneiss (of Ordovician age), so the fern would be suspected of calcareous soil tendencies. Tests of soils of specimens in the National Herbarium, from the locality at Smuggler's Notch, showed in fact neutral to very slightly acid reactions, confirming the correctness of this inference.

Most of the recorded occurrences of *Asplenium Bradleyi* are on sandstone, schist or gneiss rocks; there are only one or two references in the literature to its occurrence in limestone regions, and apparently none to its actual growth on limestone rocks. The statement in some manuals that it prefers limestone is thus clearly erroneous. It has been studied in the field only along the Susquehanna River in southern Pennsylvania, where the rock is schist and the soil reaction mediacid to subacid. Tests on herbarium specimens from Glen Onoko, Pennsylvania, Baltimore County, Maryland, and Whitfield County, Georgia, showed the same reactions. This species is therefore to be classed as an acid soil plant, but slightly tolerant of calcium. *Asplenium gravesii*, the hybrid between this and *A. pinnatifidum*, is stated to grow with the parents on sandstone rock, and is undoubtedly also partial to acid soils.

The relations of *Asplenium montanum* are practically identical with those of the preceding species. Reported almost exclusively on sandstone, schist, or gneiss and only in one or two doubtful instances on limestone, it would be suspected to be an acid soil plant; and the writer's tests upon it, at a number of localities in Pennsylvania, Virginia and West Virginia, have demonstrated the correctness of this conclusion. Its soil reactions are dominantly subacid, and it is relatively intolerant of calcium. The related *Asplenium Ruta-muraria* belongs, however, quite as definitely in the other class. The two or three reports of it on other rocks than limestone refer to shale, schist, and trap, on which calcareous soils often form. Observations made upon it, at several localities in Vermont, Pennsylvania, Maryland, and Virginia have shown it to be in fact practically limited to soils made up of limestone fragments; and it has not been found in material of more than the slightest degree of acidity, so it is classed as a calcareous soil plant prac-

tically intolerant of acid. The contrast between these two species will receive further attention later on.

Polypodium vulgare is difficult to characterize, as its habitats exhibit a wide range in both rock and soil character. It appears to be definitely limited however, on the acid side, failing to grow in mediacid soils; and, as it does grow in alkaline humus, even though infrequent on bare limestone rocks, it is classed as a calcareous soil plant rather tolerant of acidity. *Polypodium polypodioides* (*incanum*) belongs, however, to the other class. The reaction of the humus on tree trunks, in which it grows most frequently, is of course decidedly acid, often reaching the highest degree here considered. Subacid reaction is shown by the occurrence of this species on schist rock near Widewater, Maryland. It has been reported on limestone at several localities, but at the one available for study, in the gorge above Natural Bridge, Virginia, which is probably typical, its roots are embedded in thick moss coating the limestone ledges. The upper part of this moss, in which most of the fern roots lie, is distinctly acid in reaction, and only the layers nearest the rock have the acidity neutralized. As the spores of the fern must have fallen and started to grow in the acid portion of this moss, such occurrences are not an indication that it is other than an acid soil plant, at most somewhat tolerant of calcium.

Woodsia glabella is well known to occur on the cliffs of calcareous gneiss at Willoughby Lake, Vermont, and repeated tests made there showed circumneutral reactions throughout, the fern avoiding strictly the patches of subacid soils which occur here and there in that region. This fern has been reported, to be sure, in a few places where the rocks are not known to be calcareous, but most of its localities are definitely in limestone regions. The rarer *Woodsia alpina* (*hyperborea*) is found in the same localities but in more exposed situations,

where lime becomes more or less leached from its soils. These ferns are both classed as calcareous soil species, the latter the more tolerant of acidity.

Woodsia Ilvensis has been recorded most frequently on noncalcareous rocks, comprising sandstone, shale, schist and trap, and not a single mention of its occurrence on limestone could be found in the literature. One colony of it was observed at the extreme top of the Willoughby cliffs, so exposed as to be subjected to thorough leaching by the rain, and tests of the soil showed it to be somewhat acid, in spite of the calcareous nature of the adjacent gneiss rocks. In numerous occurrences of the same species in Pennsylvania, as well as one in West Virginia, the rocks are sandstone and shale, and the reactions are dominantly subacid. Although not found in the most acid soils, this species seems most correctly classified as an acid soil plant fairly tolerant of lime. The more abundant and widespread *Woodsia obtusa* grows on all sorts of rocks, but is best developed on limestone. When growing on schist and similar rocks its soil reactions have been found to be often subacid, so it is classed as a calcareous soil species rather tolerant of acidity.

Filix (Cystopteris) bulbifera grows, throughout the region covered, mostly in talus at the bases of cliffs of limestone as well as of various other rocks. Its soils are likely to contain considerable leafmold, and to be circumneutral in reaction, subacid reactions having been but rarely observed. It is evidently to be classed as a calcareous soil species, somewhat tolerant of acidity. The even more abundant *Filix (Cystopteris) fragilis* grows on ledges of sandstone, schist and shale, as well as of limestone rocks, and also in talus and in woods entirely apart from any rocks. Tests of its soils have given about the same results as with the preceding species, but as would be expected from its growth on the

rock types first mentioned, it is still more acid-tolerant. It avoids, however, mediacid soils.

Although there has been no opportunity to study *Dryopteris* (*Aspidium*) *fragrans* in the field, its relationships seemed of sufficient interest to make tests on herbarium specimens worth while. It has been recorded as growing on presumably noncalcareous slate or schist in several northern regions; but as appearing most commonly in localities where limestone rocks are dominant, although in exposed situations, where the lime might be leached out by the rain. The National Herbarium contains specimens with soil adherent to the roots from the cliffs of schist rocks at Smuggler's notch, and those of limestone conglomerate near Bic, Quebec. As anticipated, the soil reactions in both of these cases proved to be distinctly acid. The acidity is not, however, great enough to throw doubt on the correctness of its usual classification as a calcareous soil plant, if it is regarded, like several others belonging in this class, as rather tolerant of acidity.

SOIL REACTION AND PLANT RELATIONSHIP

Close relationship between plants, whether they be classed as separate genera, species, or varieties, implies derivation either from the same ancestor or from one another, by some process of natural selection, mutation, or hybridization. Studies of soil reaction, such as are described in the present paper, are of course not capable of deciding what source or what process were concerned in any given case; but when, as in certain of those above described, two related plants show a marked difference in soil preference or in tolerance to acid or to calcium, it is perhaps safe to infer that neither represents a present-day mutant or hybrid of the other.

In the case of the genus *Cheilanthes* the data are inadequate for discussion. Of the *Pellaeas*, however, one, *P.*

atropurpurea, is much more tolerant of acid conditions than the other. *Camptosorus rhizophyllus* and *Asplenium pinnatifidum*, which seem to the writer to be more closely related than the usual nomenclature would suggest, because of their convergence in such characters as structure of the cells in their stipes and scales, rooting at the frond-tips, and even netted arrangement of veins,[5] as well as the ability of the former to hybridize with at least one species of *Asplenium*—are even more strikingly different in soil preference. The former is a calcareous soil plant, somewhat tolerant of acidity; the latter, an acid soil plant, only slightly tolerant of calcium.

Asplenium Bradleyi is essentially identical in soil requirements with *A. montanum*, both being acid soil plants intolerant of calcium; but the relative of the latter, *A. Ruta-muraria*, differs radically in this respect, being an alkaline soil plant, almost intolerant of acidity. *Polypodium vulgare* and *P. polypodioides* also differ in their ultimate soil preference, although overlapping considerably in range of tolerance. *Woodsia glabella* is a calcareous soil species intolerant of much acidity, while the related *W. Ilvensis* is an acid soil plant not very tolerant of calcareous matter. It is interesting to note that *W. alpina*, which is intermediate between these in morphologic characters, is also intermediate in its preference to soil reaction. Finally, *Filix bulbifera* and *F. fragilis*, while alike in being calcareous soil plants, differ distinctly in tolerance for acid, the latter showing the greater.

Adaptation to contrasted soil reactions, with the physiological divergence it implies, seems to the writer likely to have required a long period of evolution. It is true that in a research frequently cited, Sadebeck[6] believed that he had produced a change of two *Asplenium*s

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[5]Waters, C. E. Fern Bull., 10, 2, 1902.

[6]Ber. Sitz. Ges. Bot. Hamburg, 3, 4, 1887.

into related but physiologically distinct species in six generations. But some authorities on European ferns question the distinctness of the species concerned; moreover, it was possible to produce the alleged change in one direction only; and finally, the supposed physiological distinctness was not a matter of favoring acid on one hand and calcareous matter on the other, but tolerance to presumably high magnesium content of soil derived from serpentine rock, as contrasted with low magnesium content typified by ordinary garden soils.

In this connection it may be pointed out that in the case of *Asplenium ebenoides*, which is regarded by most authorities as a recent hybrid between *Camptosorus* and *Asplenium platyneuron*,—a view that has been confirmed experimentally—the hybrid does not deviate essentially in soil requirement or tolerance from its parents. The same is evidently true of *Asplenium gravesii*, also a present-day hybrid. It therefore appears that in the pairs or groups of related species above shown to exhibit contrasts in soil reaction, the greater the divergence in reaction, the longer time has been required for their development since the original separation. In the three most strongly marked cases, namely *Camptosorus* and *Asplenium pinnatifidum*, *Asplenium montanum* and *A. Ruta-muraria*, and the small *Woodsias*, it would be inferred that the separation occurred at some fairly remote geological time.

It may be urged, then, in concluding this paper, that in future discussions of relationships between such reaction-sensitive plants as these rock ferns it will be well worth while to pay some attention to the soil reactions.

WASHINGTON, D. C.

The Story of a Fern Garden—I

Edward Hale Clarkson

In planning my fern garden I had rather ambitious ideas, especially as instead of being under fine old trees in a picturesque woodland valley with an inviting trout brook, this garden was to be in a city yard with a prosaic rubber hose to furnish water.

What I wanted was not merely a place where ferns would grow. For several years I had been studying the ferns in the woods, having in mind the eventual construction of this garden, and had learned to appreciate how effectively their beauty is brought out by appropriate surroundings. Therefore I had visions of green trees, and enticing paths bordered by clumps of mountain laurel and pungent sweet-pepper bushes, a place of restful leafy shade shut off as much as possible from all surrounding sights of civilization by a screen of shrubbery. And then, having prepared the setting, I would fill it in with the real gems—the ferns—and perhaps with a few of the choicest wild flowers.

Selecting the Location.—The place selected for the garden was the southerly half of a rectangular piece of lawn, the whole area being 120 by 90 feet. This was bordered on three sides by good-sized trees—spruce, sugar maple, red maple, several concolor firs, a picturesque clump of canoe birches, a white pine, and an old cherry tree—these trees not only making a very attractive frame for the garden, but also furnishing considerable shade and a first-class wind break. Along the easterly and southerly boundaries of this lawn ran a solid board fence nearly six feet high, which while admittedly not particularly ornamental was of real value in shutting out drying and destructive winds. The whole area sloped gently toward the north, thus insuring good drainage, and the soil was a good sandy loam.

CONSTRUCTION.—Having removed the turf from a strip along the fence averaging from thirty to forty feet wide and one hundred feet long, I staked out my paths, one long one running the full length, and several cross paths, the result being the dividing of the coming garden into nine various sized and irregular shaped "islands," as I call them, on which to plant my trees, shrubs, and ferns. There was also a border from three to six feet wide extending along the fence a distance of about one hundred and fifty feet. None of my paths were built in a straight line, and I paved some of them with irregular stone, making them attractive in appearance, and also furnishing a firm dry walk for the early spring days when the ground is soft and muddy. On my "islands" I planted about thirty trees—sugar maple, red oak, American linden, moose maple, beech, red maple, willow,—these trees averaging from ten to fifteen feet tall, with good branching tops for shade, and I scattered them about irregularly to give as natural an appearance to my little "woods" as possible. As these trees grew larger, I, of course, planned to cut out more or less of them, keeping only the most desirable. Under the trees I grouped clumps of Mountain Laurel, Sweet-Pepper bushes, *Azalea viscosa*, *Azalea nudiflora*, *Rhododendron catawbiense*, and the common Barberry. I also raised the surface of all my "islands" several inches by spreading over them a mixture of peat and sandy leaf mould. This left my paths much lower than the rest of the garden, for I had planned these paths to also serve as gutters to carry off surplus water.

GOING AFTER THE FERNS.—All was now ready for the ferns. A horse of mature age, a wagon ditto, several suits of old clothes, and a good heavy grub hoe, all played important parts in my many collecting trips. The first of these was after the "big three," the Osmundas. At Pettingell's swamp, a strip of wet woods

lying along the salt marshes of Newbury, these ferns grew by the thousands. To my mind there is no sight more beautiful than the unrolling of the fronds of these big ferns, and the day I went after them it happened that they were in exactly the right condition to transplant, the crosiers being partly unrolled, so that it was easy to select the most vigorous plants. Even with a new heavy grub hoe with a very sharp cutting edge, it was strenuous work wrestling with the tough old roots of these plants, many of which had apparently been there for an hundred years or more. Some of the clumps that I hewed and pried out must have weighed over two hundred pounds, and it was quite an engineering feat to get them into the wagon. These were taken home and planted the same day on Osmunda "island" in my garden. Actually I won these ferns "by the sweat of my brow," and was badly lamed up for the next few days.

The finest clump of the Dodge hybrid (*Dryopteris cristata* × *marginalis*) that I have in my garden is one that I found on Friday, April 13, 1917. Up to that date I had never seen this fern growing. So I started off in the morning determined to spend the day in hunting for it, and, incidentally, to try and shatter forever the "Friday, the 13th," superstition. At that time the fronds of all the evergreen ferns were, of course, flat on the ground, but I knew a promising rocky valley where both the parent ferns grew, and, after hunting for about an hour, was rewarded by finding a splendid clump of seven plants. The fertile fronds, which had been remarkably well preserved by a heavy blanket of snow that had covered the ground most of the winter, were large and delightfully irregular, measuring nearly three feet in length.

Although strongly tempted to give details of other most interesting journeys after the ferns, I realize that

to do so would unduly lengthen this article. Spread out over two seasons, these collecting trips finally resulted in the filling in of all my "islands," and today my garden is actually "overflowing."

THE FERN GARDEN TODAY.—Good-sized clumps of the giant Osmundas with their masses of tall foliage give a very natural and "woodsy" appearance to my garden. I have used the Interrupted fern more freely than either of the other two. At its best this fern is a wonderfully fine foliage plant, and deserves to be used extensively to beautify private grounds and public parks. In this section it may be had in unlimited quantities for the digging, and will grow large and thrifty if given plenty of moisture. Moreover, it keeps its fresh light-green color all through the summer, and seems to have few insect enemies.

The Ostrich fern is superb early in the season, and this also I have used in masses to advantage. Unless unusually well protected from the wind, however, it is apt to get rather shabby in late summer.

The Christmas fern is a great favorite of mine and the good-sized clumps of this evergreen, with its rich olive glossy foliage, are very effective planted along and close to the paths. After the frosts have cut down the less hardy species in the autumn it is a pleasure to see this fern still as handsome and thrifty as ever.

The Braunii is a very attractive fern, and grows well for me, but it is much more difficult to succeed with than is the Christmas fern.

The most attractive family of ferns, however, is the "Dryopteris" group. The eight so-called "wood-ferns," *D. spinulosa*, *intermedia*, *dilatata*, *Clintoniana*, *cristata*, *marginalis*, *Goldiana*, and *Filix-mas* are, to my thinking, in a class all by themselves and are very satisfactory. Five of these are evergreen; all of the eight are fine big ferns, are easily grown, and certainly

are extremely beautiful. The Goldiana is superb, and is by many persons considered our finest New England species. It is most effectively used as an individual plant. *Dryopteris intermedia* because of its exquisite fine-cut evergreen foliage and its endless variation is particularly attractive, and a good-sized garden could be devoted to this one species to advantage.

The hybrids, *D. cristata* × *intermedia* and *D. cristata* × *marginalis* are both good garden ferns. I have a dozen clumps of the first-named, and they are so thrifty and vigorous that they always attract much attention.

Newburyport, Mass.

(To be continued.)

More Interesting Fern Localities.

Mr. Winslow's article on Willoughby Lake as the richest fern locality has served to set those of us who live in north-central Connecticut counting our species. The results show that we cannot surpass the Vermont lists in number of species and do not possess anything quite so rare as the Hart's-tongue at Green Lake, but that we have a region with a diversified fern flora and different in many of its conditions from any of those treated by Mr. Winslow. So, rather by way of comparison than competition we are moved to say something of our own treasure-spots for ferns.

The central lowland of Connecticut comprises the valley of the Connecticut River north of Middletown and those of the Farmington and Quinnipiac west of it. The underlying rock throughout is a red sandstone of Triassic age. According to the geologists, it was, at three different times during the period of its deposition, broken by lateral pressure. Through the openings thus made, molten lava (trap rock) was forced up from below and spread out into great sheets, at first horizon-

tal, later tilted in a northwest-southeast direction by the great Adirondack mountain-making movement. The softer rock around them has been worn away by erosion and their uplifted edges now form a long ridge, running north and south which usually slopes gradually on the east side and is very abrupt on the west. Over one of the sheets is, or was, a thin vein of impure limestone. From this and the decomposition of the trap itself sufficient calcium salts are furnished to the soil to support, in favored spots, such lime-requiring species as the wall-rue spleenwort and the purple cliff-brake. On the floor of the lowland the underlying rocks are nearly everywhere buried deep under glacial deposits of clay, gravel and sand. The sandy areas, with their attendant swamps, furnish congenial habitats for coastal plain and other species of acid soils.

Fern lists have been sent in to the JOURNAL from three localities lying along the trap ridge on a line of about 25 miles. The first, from Mr. Irving Holcomb, contains, reckoned on the basis used by Mr. Winslow, 34 species. It covers the entire town of Granby, some 40 square miles; but most, if not all, of the species, could probably be found within a much smaller area. Mr. H. C. Bigelow reports 31 species from a triangle a mile at base and extending out two miles on the west slope of the ridge in the town of Plainville. But perhaps the most remarkable list for this region, because of the very small area it covers, is that sent in by Dr. E. H. Munger.[1] At one point, also on the west slope of the ridge, in the town of Avon, there is a hollow in which water settles, forming a small swamp. This is drained by a stream which flows for a short distance under ground and finally finds its way to the valley through a water-worn cleft in the lower wall of the hollow. Here, on cliff and in swamp and ravine, within

[1] Dr. Munger has also furnished most of the geological information given above.

a triangle with a base of three-quarters of a mile and sides of five-eighths, are found 30 species of ferns.

Of the 27 species listed by Mr. Winslow as common to all his localities, 22 are also in the Connecticut lists. Two, *Cryptogramma Stelleri* and *Cystopteris bulbifera*, are not in any of them, though the latter occurs at three stations between Dr. Munger's and Mr. Holcomb's areas. Only Mr. Holcomb reports *Phegopteris Dryopteris* and *Asplenium Ruta-muraria*, the latter the rarest fern of this region, but he lacks *Dryopteris Goldiana* which the other two have. All the Connecticut lists have *Phegopteris hexagonoptera*, *Pellaea atropurpurea*, *Woodwardia virginica*, *Asplenium platyneuron*, *Woodsia ilvensis* and *W. obtusa*. Two have *Dryopteris simulata*, two *Lygodium palmatum*. Dr. Munger alone has *Athyrium angustifolium*, Mr. Holcomb alone *Phegopteris polypodioides*, and Mr. Bigelow is the sole finder of *Woodwardia areolata*.

Taken together, the Connecticut lists show 36 species, four less than the total given by Mr. Winslow. *Cystopteris bulbifera*, found within two miles of the Granby town line, brings the total for the region to 37. It lacks, naturally, the northern species found in the Vermont and New York localities, but has the four southern ones absent there. It lacks such specialities as *Scolopendrium* and *Woodsia alpina*, but has one of its own in *Lygodium*. And (if hybrids may be mentioned, even if they do not count) Mr. Bigelow has found 15 plants of *Asplenium ebenoides*.

As to Ophioglossaceae, Dr. Munger has yet to find Ophioglossum; otherwise we have all the Gray's Manual species of this family except *Botrychium Lunaria*.

The Dorset Fern List Again.—A friend has brought to my attention a note which I had overlooked in pre-

paring the article on Willoughby Lake, etc., which appeared in Vol. 9, No. 4 of the FERN JOURNAL. In the *Fern Bulletin*, Vol. 15, page 49, Mrs. Terry reports the finding in Dorset of *Botrychium simplex* and *Pellaea atropurpurea*. Therefore Pellaea should be added to the list of ferns growing in all four stations under consideration, making a list of 28 This gives Dorset 35 true ferns, which equals the Willoughby list. It only remains for Mrs. Terry or some other Dorset botanist to discover *Phegopteris hexagonoptera* or the male fern to give that town the undisputed championship.—E. J. WINSLOW.

ANOTHER CHARACTER IN THE BEECH FERNS.—Living plants of *Phegopteris hexagonoptera* and *P. polypodioides*, if one can keep them under obsrvation, are easily told apart. When the fronds of the Long Beech Fern die down in the autumn, or even for a short time previously, the coiled tops of the next year's croziers, thickly covered with brown scales, may be seen protruding a little above the ground. In the case of the Broad Beech fern, however, no traces of the next year's fronds show above the ground either in the fall or early spring. The Long Beech fern matures its fronds much earlier than the other. Around Sept. 1st in the vicinity of Newburyport fronds of *hexagonoptera* of a fine fresh green may be seen in various stages of unrolling. But at that time all the fronds of the other have turned to a dull, homely olive and no new fronds are to be seen. Even a long series of rains in July and August which will bring out a second crop of fronds on quite a number of the ferns, do not seem to have any effect on the Long Beech.—E. H. CLARKSON, *Newburyport, Mass.*

American Fern Society

Report of the Treasurer for 1919

RECEIPTS

Cash on hand, January 1, 1919			$167.33
Membership dues for	1917	$ 7.10	
	1918	35.20	
	1919	216.40	
	1920	11.00	
	1921	1.00	
			270.70
Subscriptions,	1918	$ 1.80	
	1919	32.58	
	1920	6.12	
			40.50
Collection Fees			1.00
Advertising			7.00
Illustrating Fund			14.83
Emergency Fund, sale of back numbers			12.10
Interest			6.00
Total receipts during the year 1919			352 13
Grand Total received			$519.46

DISBURSEMENTS

Secretary's expenses: postage, election of officers, etc., etc., per as budget		$ 15.91
Treasurers expenses: printing and postage as per budget		15.00
Vice-President expenses, postage		1.00
JOURNAL expenses: Printing and Illustrating: Budget	243.00	
" " " " " Deficit	22.55	
Illustrations from Illustrating fund	19.25	
Illustrations advanced to be refunded by contributor	16.75	
Total JOURNAL expenses		$301.55
Total paid out		$333.46
Balance on hand to 1920		186.00
		$519.46

This Balance includes the following:

Emergency Fund, January 1	$ 65.99	
Received	12.10	
		78.09
Illustrating Fund, January 1	5.75	
Received	14.83	
Total	20.58	
Paid out	19.25	
		1.33
Carried Forward		79.42

Brought Forward	79.42
Set aside for printing catalog of the Herbarium	25.00
Set aside for Herbarium supplies by 1919 Budget	10.00
Regular Fund available for regular use	71.58
	$186.00

Special Fund created by Life Memberships and Transfers from the Emergency Fund.

On Hand January 1, 1919	$100.00
One Life Membership	15.00
Accrued interest	13.97
	$128.97

Respectfully submitted,

J. G. UNDERWOOD, *Treasurer*

Kenneth Bradford Laird was born in Brockton, Massachusetts, in 1893. He attended the public schools of that town and early showed an interest in plant life. During his summers, which were spent at Pocasset, Massachusetts, he devoted much time to collecting. This love for collecting and knowing plants was always characteristic of him. He entered Massachusetts Agricultural College in the autumn of 1912. While a student here, he specialized in botany and distinguished himself by his good work in all his studies. Encouraged by Professor A. Vincent Osmun, Laird became especially interested in ferns and other cryptogams. It was the good fortune of the writer to be closely associated with him during his four years in college and "Kek" Laird is a friend never to be forgotten. After graduating from M. A. C. in 1916, Laird became a teacher of botany in the high school of Hartford, Connecticut. Here he remained one year, doing excellent work, when he was appointed instructor in botany at New Hampshire State College. An industrious and conscientious worker himself, he required his students to show a similar industry. Laird joined the army in the summer of 1918, being attached to the Sanitary Corps. While

in uniform he contracted influenza, and died of that disease in New Haven, Connecticut, in the autumn of 1918. His great love for plants, his skill as a pianist, and his enthusiasm and his kindness to everyone are a few of the principle characteristics of this man which we shall not forget.—WM. L. DORAN.

Miss Lura L. Perrine, for 23 years a member of the Society, died recently at Vancouver, B. C. Miss Perrine was born in 1854. She graduated from Albion College and soon afterward took up teaching. After her father's death in 1882, the family, consisting of the mother and three daughters, moved to a prairie farm in North Dakota. They were the first family to settle in their township and among the first unmarried women to enter that region, but they faced bravely and successfully the labors and trials of pioneer life. Miss Perrine had her share in building up the local school system, and in 1892 was offered and accepted a position in the Valley City Normal School. She soon became head of the Department of Science in that institution and remained a member of its faculty until her death.

Herself full of enthusiastic interest in her subject, she was an unusually inspiring and successful teacher. In addition to her direct work of instruction, she founded a school museum which, under her direction became one of the best of its kind in the country, well stocked with illustrative material in all the branches of science taught.

Indigenous ferns are very rare in the prairie state of North Dakota. On the terraces of her yard, sloping to the river, Miss Perrine had a fern garden, in which various species brought by her from all the northern parts of the country from Maine to Vancouver Island, throve under her care. "Her love for all plants was a veritable passion."

We are glad to be able to inform members interested that the indicators used in making the tests described in the article by Dr. Edgar T. Wherry can be obtained from the La Motte Chemical Products Co., 13 West Saratoga St., Baltimore, Md. The price of a set of six solutions, made up for field use, is $2.85.—Adv.

Owing to Mr. Maxon's absence on a collecting trip to Jamaica, the President's report is again delayed.

American Fern Journal

Vol. 10 JULY–SEPTEMBER, 1920 No. 3.

The Fern Flora of Alabama

E. W. Graves

Alabama lies principally between latitude 30° 31′ on the Gulf of Mexico, and 35° under the rim of the Tennessee highlands, presenting two well-marked divisions. The upper or northern half, lying in the rugged mountains of the southern Alleghanies, offers great complexity in its geological formation, almost every stratum of various epochs being represented here. This gives rise to greater diversity of topography and soil than exists in any other of the Gulf States, thus producing that variety of flora seen in few of her sister States.

The lower or southern division can be considered as a vast plain of great uniformity in its general features; gently undulating where the loose sedimentary strata of the Post-tertiary formation prevail, and broken where the cherty ridges of the Tertiary and Cretaceious rocks offer greater resistance to erosion by water.

The altitude of the State begins at sea level in the extreme south and rises gradually until more than 2000 ft. is reached in the northern part of the State.

The flora of Alabama is unsurpassed by any of the surrounding states, with the possible exception of North Carolina, having about 5000 species and varieties recorded to its credit. Forty different species of orchids have been found growing in the State, possibly a larger number than could be found in any neighboring state except Florida. Some of the rarer orchids of the eastern United States I have found plentiful in Ala-

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[Vol. 10, No. 2 of the Journal, pages 33-64, was issued June 29, 1920.]

bama. *Habenaria integra* which is so scarce in most other states, I found growing by hundreds in a large swamp near Whistler in Mobile County. The rare *Pogonia verticillata* is quite common on the table-lands of the northeastern part of the State. *Spiranthes Beckii*, which is a rare orchid in the south, I found near Spring Hill.

Seven of the Trilliums, six of the Sarracenias, or Pitcher-plants, ten Sabbatias, which bear such beautiful flowers throughout the summer, and thirty-two of the Solidagos or Goldenrods, with a large representation of the Eupatoriums, are found within the borders of the State.

Of the ferns found in North America, Alabama can boast of several of the rarer species; among them are *Trichomanes Petersii*, *Asplenium ebenoides*, *A. Bradleyi*, *A. pinnatifidum*, and *Dicranopteris flexuosa*. Of the first named fern Alabama holds four of the six known stations; of the last the State holds the only station in the United States.

Vermont with its sixty-eight ferns, including twelve Lycopodiums, has been termed, "The fern-lover's paradise." My list for Alabama shows seventy species of ferns including nine Lycopodiums, placing it fourth among the states of the union, Pennsylvania, Florida, and New Jersey only having larger lists.

In the preparation of this paper I have corresponded with Dr. E. A. Smith, state geologist, Dr. R. M. Harper, state botanist, Mr. W. R. Maxon and Mr. A. H. Howell of Washington, D. C., and have been aided by association with Mr. W. C. Dukes, Mr. H. P. Löding and Dr. Van Aller of Mobile. With the last named I have made many a trip afield. To these gentlemen I express a word of thanks. I have also consulted Mohr's *Plant Life of Alabama*, the *Fern Bulletin* and the FERN JOURNAL.

I have spent ten years in the State, collecting in the following Counties: Jackson, DeKalb, Marshall, Madison, Morgan, Etowah, Blount, Jefferson, Walker, Winston, Culman, Colbert, and Lauderdale, in the mountain district of the north part of the State; Baldwin, Clark, and Mobile, of the southwest; and Perry and Hale counties of the central district of the State. In some of these counties I have collected sparingly while in others I have done some extensive collecting. Jackson and DeKalb counties within whose borders are some of the highest and roughest mountains of the State, and which extend farthest north, and Mobile county, where is found the lowest swampy ground and which extends farthest south, is where I have done most of my collecting.

OPHIOGLOSSACEAE

OPHIOGLOSSUM CROTALOPHOROIDES Walt. Found from mountain region to coast plain. Auburn, Lee Co. (Underwood & Earle); in Mobile Co., I found quite a colony in a dry pasture four miles west of Spring Hill. Mr. W. C. Dukes found it plentifully at Spring Hill.

OPHIOGLOSSUM PUSILLUM Nutt. Mohr reports it from Mobile Co., saying it is very rare. Mr. W. C. Dukes told me he found one specimen near the Alabama river at Magazine Pt., above Mobile.

BOTRYCHIUM OBLIQUUM Muhl. I have found it common throughout the state. I have specimens from Jackson, DeKalb, Hale, and Mobile counties.

BOTRYCHIUM BITERNATUM (Lam.) Underw. Found sparingly at Spring Hill, the only place recorded in the state. I found several colonies in the shade of Pine trees there.

BOTRYCHIUM ALABAMENSE Maxon. This fern I found quite common around Spring Hill and several

miles to the west and to the north of the hill. It grew in shady places often under second growth timber.

BOTRYCHIUM VIRGINIANUM (L.) Sw. Throughout the State, principally in the mountain district.

POLYPODIACEAE

POLYPODIUM POLYPODIOIDES (L.) Watt. Common on rocks and trees throughout the state. The Live Oaks in Mobile county seem to be its preference as in some instances the body and limbs are simply covered with the fern. Occasionally I have seen it growing on the ground in damp shady places. I found what might be considered by some a new variety. The two lower pinnae were eared below.

POLYPODIUM VULGARE L. I have found it very common throughout the mountain region of the north, but I believe it has never been reported from the southern part of the State.

ADIANTUM CAPILLUS-VENERIS L. Common in the southern half of the state, but rare and local in the north. However, I found plants growing out of crevices in limestone along the Tennessee river. In the south I found it growing on a brick wall in the city of Mobile. Dr. Van Aller told me the limestone cliffs up the Alabama River were lined with it.

ADIANTUM PEDATUM L. Common in the mountain region of the north part of the State extending as far south as Hale county where I found it growing. Dr. E. A. Smith reports it from Tuscaloosa county the next county north of Hale county.

PTERIS AQUILINA L. Abundant everywhere throughout the State, growing in sun and shade alike.

PTERIS AQUILINA PSEUDOCAUDATA Clute. Central prairie belt to coast plain. Sandy shaded banks and thickets, Mobile Co., frequent.

PTERIS SERRULATA L. Very common in Mobile Co. First observed in 1870, since spreading along the banks of water courses and ditches, and on old walls. In the city of Mobile one finds it growing on most all brick walls, sometimes ten or fifteen feet above the ground. Dr. Smith sent me a specimen from Tuscaloosa where he found it growing.

PTERIS LONGIFOLIA L. This fern to my knowledge, had never been collected in the State, until I found about a dozen plants growing on a brick wall on West Congress St., in Mobile. The building was old facing the east, and shaded by a large tree. On the wall with *P. longifolia*. grew *Dryopteris normalis*, *Pteris serrulata*, and several weeds. The plants were not large; some had fronds perhaps fifteen inches long. Most of them were much smaller.

CHEILANTHES ALABAMENSIS (Buckl.) Kunze. Grows on limestone in north part of the State. Dr. E. L. Lee, of Bridgeport, Ala., told me that it grew plentifully on the west side of Sand Mt. near the Tennessee river, but I never saw it in the county. I found it growing rank, almost a foot tall, near Florence, in Colbert Co. Mohr reports it from Winston Co., Etowah Co. and Bibb Co.

CHEILANTHES LANOSA (Michx.) Watt. Mountain region of the northern half of the state, on sandstone. I have found it in Jackson Co., Jefferson Co., Colbert Co., DeKalb Co. and Hale Co. Mohr reports it from Cullman, Lauderdale, and Tuscaloosa counties. Smith reports it from Bibb Co.

CHEILANTHES TOMENTOSA Link. Rather common in the mountain region of the north. On Sand Mt. it grows at an altitude of 1200 ft. I have never found it lower than 600 ft. Mohr reports it from Cullman Co. 800 ft., Blount Co., 600 ft., Talladega Co., Alpine Mt. Signal Station, 1800 ft. and Lauderdale Co., 500 ft.

I found large specimens twelve inches long at Black Creek Falls in Etowah Co., at about 1000 ft. altitude.

PELLAEA ATROPURPUREA (L.) Link. Mountain region of the northern part of the State. Mohr says it is nowhere abundant but I found it quite plentiful on Sand Mt. growing on limestone, and on the plateau I found quite a number of plants growing on sandstone cliffs. I found it also in Etowah Co., at Black Creek Falls and in Marshall Co., and northwest of Birmingham in Jefferson Co. It is reported from Lawrence Co. by T. M. Peters, Madison Co., Lauderdale Co., and Clay Co., by Mohr and from Tuscaloosa Co. by Smith.

WOODWARDIA AREOLATA (L.) Moore. Distributed over the State in shaded sandy swamps. This is one of the most abundant ferns of the State. I found it common on Sand Mt. in Jackson and DeKalb Counties, and very abundant in Mobile and Baldwin Counties. I also found it in Hale Co.

WOODWARDIA VIRGINICA (L.) Sw. Frequent along the coast and on Sand Mt. plateau in the north, but rare in the interior. I have found it in Jackson, DeKalb, Mobile and Baldwin Counties. Dr. Smith reports it from Russell Co.

ASPLENIUM PINNATIFIDUM Nutt. Mohr reports this fern from the mountain region and the Tennessee valley, but I have never found it in the valley region. I have found it quite plentiful in the mountains. On the brow of Sand Mt. and the Cumberlain Mts. in Jackson and DeKalb Counties it grows in protected crevices. On the plateau wherever a sandstone cliff protrudes out of the soil with an eastern exposure one is almost sure to find a few plants, though usually small. In the year 1917, I found some beautiful large specimens on the high cliffs overlooking Long Island. These plants were very peculiar, being twice pinnatifid. Some of the plants produced fronds two and a half inches wide, and

eight inches long. The incisions were cut almost to the midrib, and the lobes were again deeply incised. I have found hundreds of plants but never have I found plants like these. I have found *A. pinnatifidum* in Jackson Co. near Bridgeport and Long Island, in DeKalb Co. near Fort Payne, in Marshall Co. west of Guntersville, and in Etowah Co. Mohr reports it from Cullman Co., Winston Co., Marion Co. and Lauderdale Co.

ASPLENIUM BRADLEYI Eaton. This fern is found only in the mountain region, and grows on the same kind of rock that *A. pinnatifidum* grows on, that is, sandstone, not limestone. I have found hundreds of plants and have never found it on limestone. Often I have found both these ferns in the same crevice growing near each other. *A. Bradleyi* has been recorded from only three Counties in Alabama, Jackson, DeKalb and Clay Counties. Only one small specimen was found in Clay Co. I have found it very plentiful in Jackson Co. Most of the plants were rather small, but in 1917, I found a good many nice plants, some with fronds ten inches long.

ASPLENIUM GRAVESII Maxon. Most of the plants of this fern that I found were found just across the line near Trenton, Ga. Only one plant was found in Alabama, near Bridgeport, on Cumberlain Mt. This hybrid always grew in the same vicinity with *A. pinnatifidum* and *A. Bradleyi*. Dr. Maxon gave a good description of it in Vol. 8, No. 1 of the American Fern Journal.

ASPLENIUM PLATYNEURON (L.) Oakes. This fern is found over the whole State on all kinds of soils. Common most everywhere.

ASPLENIUM PLATYNEURON SERRATUM (E. S. Miller) BSP. This variety is found usually with the type. I have found it in Jackson, DeKalb, and Mobile Counties.

Asplenium Gravesii Maxon
(A. Bradleyi × pinnatifidum)

ASPLENIUM PLATYNEURON INCISUM (E. C. Howe) Robinson. This variety I have found only in Mobile Co., near Spring Hill, in a deep damp ravine. This is a very beautiful fern with its pinnae deeply cut, often nearly to the midrib. The fronds were fourteen to twenty inches high.

ASPLENIUM EBENOIDES R. R. Scott. This hybrid has been found only in two counties of the State, Hale Co. and Marion Co. In 1918, I visited the station at Havanna in Hale Co. I found the fern still holding its own, but the plants were mostly small. I had quite a hard time finding the ravine and it was nearly dark when I came to the plants. I counted about fifty in all. It grew on almost the same kind of stone that I have found most of *A. pinnatifidum* growing on, apparently a sort of sandstone. It certainly was not limestone.

ASPLENIUM PARVULUM Mart. & Gal. Tennessee valley to lower hills. Growing on limestone on shady hillsides. I have found it only in Jackson and DeKalb Counties, being quite plentiful there. Mohr reports it from Lawrence, Lauderdale, Walker, Madison, Bibb, and Clay Counties.

ASPLENIUM TRICHOMANES L. Damp sheltered rocks and open caves, called in Alabama "rock houses." Not plentiful anywhere. Jackson, DeKalb, Etowah, Talladega, Tuscaloosa, and Clay County.

ASPLENIUM MONTANUM Willd. Mountain region, rare in most places. There are one or two places on Sand Mt. where it is rather common. It grows out of the crevices of sandstone, often in large clumps. I

EXPLANATION OF PLATE 1.—1. Frond from the type specimen, collected near Trenton, Ga., Nov., 1917, *E. W. Graves* no. 231, × ¼. The heavily fruited, mature sori are confluent. 2. A plant of the same collection, no. 231x, × 1. 3. Two pinnae from a frond of the original collection, near Trenton, Ga., March, 1917, *E. W. Graves* no. 230x, × 1. 4. Scale from the rootstock of no. 231x, × 5.

have found a number of fronds with the upper part divided, one had two divisions down the top more than an inch deep.

In one place I found a small colony of plants which seemed to be a separate variety. It was much more finely cut, there being as much difference between it and the type as there is between *Dryopteris spinulosa* and the fine cut variety *D. spinulosa* var. *Concordiana*. This colony of about a dozen plants was isolated from the other coarser plants, showing it was reproducing itself, or else it was the rocks on which it grew that caused the plants to produce fronds of a finer cutting. There are many variations among Alabama ferns which some would class as new ferns. Very unfortunate for this little fern, having grown in Alabama where few fern students live, for had it grown in the New England states where most of those versed in nomenclature live, it would no doubt be bearing a name all its own!

ASPLENIUM RUTA-MURARIA L. Tennessee valley mountains and lower hills. Growing on exposed rocks. I found a large colony growing on limestone near the Tennessee river at Sheffield, Colbert Co. Though I never found it in Jackson Co., Dr. E. L. Lee of Bridgeport told me it grew across the river from Bridgeport at the foot of Sand Mt. I have specimens which he collected there. Mohr reports it from Winston, DeKalb, and Etowah Co., and I believe also from Bibb Co.

ASPLENIUM ACROSTICHOIDES Sw. This fern I have never found growing in the State, but Mohr reports that Dr. Underwood found it in Winston Co.

ASPLENIUM ANGUSTIFOLIUM Michx. Mountain region, quite rare. I have only found it in Bucks Pocket of Sauty Creek, Marshall Co. Mohr reports it from Winston Co.

ASPLENIUM FILIX-FOEMINA (L.) Bernh. This is a very common fern throughout the State, being found everywhere. Mohr says it is most frequent in the mountains, but I found it equally as common in Mobile County, along sandy ravines. The red and white stiped varieties are both common.

CAMPTOSORUS RHIZOPHYLLUS (L.) Link. Mountain region to Central Pine belt. I have found it sparingly in Jackson Co., and in Marshall Co., near the place where I found *Trichomanes Petersii*. I found it covering the rocks in matted formation at the latter place. As I have said before, it being nearly dark when I found the *Asplenium ebenoides* station, I did not see Camptosorus there at all. Dr. E. A. Smith wrote me that he had found it there, and Dr. Underwood has stated that he found it there. Mohr reports it also from Cullman Co.

PHEGOPTERIS HEXAGONOPTERA (Michx.) Fée. Mohr gives it from mountain region to lower hills, but I have found it as far south as Mobile Co., at Salco, and Magazine Pt., growing in great patches in the beech woods. The latter place is only seven miles north of the city of Mobile. Mr. Dukes told me he had found it also three miles south of Mobile. I have found it plentiful in Jackson, Marshall, and DeKalb Counties. Mohr reports it from Cullman, Lauderdale and Tuscaloosa Counties. I believe this Mobile station is the farthest south that has been recorded.

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott. Over the State in rich woodlands and ravines. Jackson, DeKalb, Marshall, Etowah, Winston, Walker, Perry, Mobile, and Baldwin Counties.

POLYSTICHUM ACROSTICHOIDES INCISUM A. Gray. Occasionally met with in Jackson Co., with the type.

POLYSTICHUM ACROSTICHOIDES CRISPUM Clute. Only one or two plants found in Jackson Co., on Sand Mt.

DRYOPTERIS THELYPTERIS (L.) Gray. Mobile and Montgomery Co. I found it quite abundant in the first named Co., growing in swampy places. Near Whistler, Alabama, I found fronds as high as my head, and I am almost six feet tall. It was growing in a swamp among bushes.

DRYOPTERIS NOVEBORACENSIS (L.) Gray. Found in the mountain region to lower hills. A very common fern on Sand Mt. in Jackson and DeKalb Counties, growing on the borders of swamps. Mohr reports it from Lauderdale, Blount, Tuscaloosa, and Fayette Counties.

DRYOPTERIS FLORIDANA (Hook.) Kuntze. We have only one record for this fern from the State. Dr. L. M. Underwood found it near Auburn, in Lee Co.

DRYOPTERIS MARGINALIS (L.) Gray. Common in the ravines of Sand Mt. in Jackson, DeKalb and Marshall Counties. Mohr says it is infrequent in Cullman, Tuscaloosa, and Clay Counties.

DRYOPTERIS MARGINALIS ELEGANS (J. Robinson) Carhart. I found a number of plants of this fern growing with the type in a shaded ravine on Sand Mt. in Jackson Co.

DRYOPTERIS SPINULOSA DILATATA Underw. Reported from Winston Co., the only station for the State, by Mohr.

DRYOPTERIS SPINULOSA INTERMEDIA (Muhl.) Underw. I found two good colonies in deep ravines, and a friend told me of another colony, on Sand Mt., Jackson Co. This fern has not been reported from any other part of the State.

DRYOPTERIS NORMALIS C. Chr. Coastal plain and lower hills. This is a very abundant fern in Mobile Co., growing on the border of swamps, and in shady ravines. I have also found it in Baldwin and Hale Counties. Dr. Smith reports it from Tuscaloosa Co.

DRYOPTERIS MOLLIS (Jacq.) Hieron. This fern was reported to me by Mr. Dukes, as growing near a creek which runs down Fern Way in West Mobile, between Spring Hill Road, and Dauphin St. When I examined the place I found the creek had been cleaned up and concreted, so that destroyed the station. I had hunted diligently hoping to find it elsewhere, but it was not until I was about ready to leave Alabama in October, 1919, that my search was rewarded. Just north of the Electric Car Barn on Spring Hill Road by the roadside in a ravine I found a large colony of that fern. It very closely resembles *D. normalis*, but one can see the difference by examining the veining of the pinnae.

CYSTOPTERIS BULBIFERA (L.) Bernh. Mountain region on wet limestone rocks. Jackson, Colbert, Lauderdale, and Etowah Counties. Not plentiful.

CYSTOPTERIS FRAGILIS (L.) Bernh. Mountain region to lower hills. In rich woods and rocky places. Frequently met with in rich ravines.

ONOCLEA SENSIBILIS L. Throughout the State in damp places. Mohr says it is found from lower hills to Coast plain, but I have found several good colonies on Sand Mt. in Jackson Co. Mohr reports it from Baldwin Co. Mr. Dukes told me of finding it at the foot of Spring Hill in a swamp, but I could never find the station.

WOODSIA OBTUSA (Spreng.) Torr. Found throughout the northern part of the State on rocks, both limestone and sandstone. I have found it in Jackson, DeKalb and Hale Counties. In Hale Co. I found it as far south as Greensborough, the County Seat. It was reported that Prof. R. S. Cocks found it at Selma, in Dallas Co. Selma is perhaps twenty miles south of Greensborough, making it the station farthest south for the State. Mohr gives it from Winston Co. Dr. Smith reports it from Bibb and Tuscaloosa Counties.

DENNSTAEDTIA PUNCTILOBULA (Michx.) Moore. Mountain region. Rocky hillsides and open woodlands. I have found it in Jackson, DeKalb, and Marshall Counties. T. M. Peters reports it from Winston Co. and Dr. Smith from Bibb Co.

TRICHOMANES BOSCHIANUM Sturm. Mountain region to lower hills, on damp rocks. I found two stations for this delicate fern on Sand Mt. in Jackson Co. One was at the foot of a large water-fall where water was continually splashed over it and seldom froze. The other was under a ledge of rocks that were partially dry a part of the year. This station contained many fruiting fronds, but they were rather small. The former station contained larger plants, but had few fruiting fronds. In Walker Co. on a rocky wall which was damp but had the sunlight most of the day I found large colonies of small plants, but few were fruiting. Across Sipsey river in Winston Co. under ledges of rocks where the sun never shone I found the best specimens. Some of these were ten inches long, and heavy with fruit. Those of Jackson Co. never received any sunlight. It has been found in Franklin, Marion, Etowah. Hale, and Lawrence Counties. It is always found on sandstone.

TRICHOMANES PETERSII Gray. Found in four places inside the State, and only two places outside of the State. I have specimens from all six stations. It grows on damp sandstone which receives more or less water at different times throughout the year. The station I found in Marshall Co. was where the sun could reach it a part of the day. There were thousands of plants matted together. It was first observed in Winston Co. by T. M. Peters. It has since been found in Marion and Etowah Counties.

CYRTOMIUM FALCATUM (L. f.) Presl. This fern has been reported by Mr. W. C. Dukes as an escape in

Montgomery Co., and was thriving in a good-sized colony. I found one plant growing in west Mobile, on Spring Hill Road, near Ashland Place. It was growing in the side of a lawn under the shade of wild bushes, near a stone wall. I called at the residence asking if it had been purposely placed there, but the ladies told me they had been living there eight years and it was there when they came. They did not even know it was a fern. It was a large clump composed of several plants. Chickens had been scratching it and using it very hard, else other plants might have been produced by spores.

DICRANOPTERIS FLEXUOSA (Schrad.) Undw. One large plant of this fern was found by L. H. McNeill a few years ago in the lower part of Mobile Co. growing in a railroad cut. It flourished for several years, and when Mr. A. H. Howell of the Biological Survey visited the place in 1917, he found it growing nicely, and took a photograph of it. At that time Mr. Howell sent me a part of a frond. The next year when I went to Mobile, I went in company with Dr. Van Aller to the site, but we found that a steam shovel had removed the soil from the place and had evidently carried it away with the soil to fill around a bridge. We searched everywhere but could not find even a frond of the plant. The plant, though very large, had never produced any fruiting fronds. I fear it has disappeared from the State. I have searched since, but no trace was found of it.

LYGODIUM JAPONICUM (Thunb.) Sw. This climbing fern is apparently an escape in Mobile Co. Mr. Dukes found it growing along the creek near Fern Way in West Mobile. In putting in the concrete drain it must have been destroyed, as I could find no trace of it on my visit to the place. It grows in many of the lawns in the city.

OSMUNDA CINNAMOMEA L. Low damp woods throughout the State. The most abundant fern we have. In Mobile County there is a fall fruiting variety. It begins fruiting in September and produces fruiting fronds up to November. I believe the reason for the fall fruiting of this fern is the excessive rain in August, near the coast, which cause the plants to take a new start. New sterile fronds are produced also. I have never observed this fern fruiting in the fall in the northern part of the State, which does not receive excessive rains in August.

OSMUNDA CINNAMOMEA FRONDOSA Gray. I found one plant in the northern part of Mobile Co. near Salco. This fern I found in April. In September I found a very peculiar variety. The sterile fronds were very narrow, the pinnae extending about one inch on each side of the rachis. The lobes of the pinnae were not entire but triangular in shape and serrate. One frond was composed of all fertile pinnae. Another frond was fertile in the middle, and sterile above and below. The lobes of the pinnae were serrate as in the other sterile fronds. I suppose if this fern had grown in New England it too would have carried a new name.

OSMUNDA REGALIS L. Common throughout the State on the border of swamps. This fern too has the habit of fruiting in the fall, in the southern part of the State, but I have never found it fruiting in the fall in the northern part.

LYCOPODIACEAE.

LYCOPODIUM ALOPECUROIDES L. This Club Moss is frequently met with in the swamps throughout Mobile and Baldwin Counties. Mohr adds Washington Co. also. I have sometimes seen it in great masses on the border of a swamp.

LYCOPODIUM ADPRESSUM (Chapm.) Lloyd & Underw. This Club Moss I have never found, but Mohr reports it from Mobile and Baldwin Counties, growing in open pine barrens, and swamps.

LYCOPODIUM PINNATUM (Chapm.) Lloyd & Underw. Wet springy places near Spring Hill and Whistler, in Mobile Co. Quite rare. Mohr also gives it from Lee Co.

LYCOPODIUM CAROLINIANUM L. Swampy ground along the coast. I have found great colonies growing among the grass in a natural meadow, also on springy banks sparingly near Spring Hill, and Whistler, in Mobile Co. I found a few scattering plants on springy banks east of Mobile Bay in Baldwin Co.

LYCOPODIUM POROPHILUM Lloyd & Underw. I have never seen this plant, but Mohr reports that Underwood found it in Winston Co., near Sipsey river, June 1, 1896.

LYCOPODIUM CERNUUM L. Found on springy banks in Mobile and Baldwin Counties. Along the railroad track north of Spring Hill I found large patches of it on clayey soil. It is a beautiful plant because of its fine texture.

LYCOPODIUM PROSTRATUM Harper. This Club Moss is quite plentiful in the southern part of the State. It grows in swampy places. I have found it in Mobile, Baldwin, and Hale Counties.

LYCOPODIUM DENDROIDEUM Michx. To my knowledge this plant has never before been reported from the State. I found it in large colonies in pine woods, on Sand Mt. in Jackson, and DeKalb Counties. It is gathered by the mountaineers at Christmas time and sold in Chattanooga, Tennessee, for decorating purposes.

LYCOPODIUM COMPLANATUM FLABELLIFORME Fernald. This plant also has never been reported from the State before. I found two large colonies while hunting on

Sand Mt. in Jackson, Co., in company with Mr. A. H. Howell. It grew in low sandy woods near Miller Creek.

I have sent duplicates of almost all the ferns I have collected in Alabama, to the Herbarium of the American Fern Society. Any member wishing to examine them will find them there.

BENTONSPORT, IOWA.

The Story of a Fern Garden—II.

EDWARD HALE CLARKSON

The three species, well named by Clute "the marsh fern tribe," all grow well. I placed the simulata close to and on the west side of my high board fence where it gets plenty of overhead light, but very little sunshine, and it thrives, puts out fine fertile fronds, and is increasing. The Marsh fern, like *Onoclea sensibilis*, has to be violently restrained to keep it within bounds. The New York fern is one of the most satisfactory in the garden, and shows best in rather small clumps.

The Polypody is another fern that is both easy to manage in the garden and easy to transplant. Sheets of this fern may be lifted from boulders in the woods and brought to the garden in perfect condition. Placed on rock work, in a not too shady spot, the fern grows as well as before being moved.

In the case of the Brake (*Pteris aquilina*) I planted a small root four years ago—fortunately more than one hundred feet away from my fern garden—and close to the fence. It has thrived amazingly and threatens to cover both my yard and the garden next door. I would not be at all surprised if my neighbor should sue me for damages if he by any chance reads this incriminating article.

The Lady fern, most amazing in its varieties, is another obstreperous plant. To say that this fern thrives is a decidedly mild statement. I may truthfully state regarding this species that it has shown the characteristics exhibited by a young cow-bird in a summer yellow-bird's nest—a tendency to absorb the giant's share of the nourishment and to elbow the other fellow out of house and home. It spreads rapidly.

The Brake, Lady fern, Sensitive fern, and also the Marsh fern and Dicksonia should all be planted away from the others.

The Silvery Spleenwort is quite a thrifty fern, although it does not grow as large and fine here as in its favorite haunts in the woods. However, it does very well, putting out fertile fronds that sometimes measure nearly three feet in length. It suffers rather severely some seasons by being badly eaten by shell-less snails. The Maidenhair Spleenwort has grown beautifully in a rockery specially constructed for it. It appears to do best in moist pockets under shelving rocks, where the sun never shines. It insists on good drainage.

I have no luck with *Asplenium angustifolium*. It lives, it is true, but its fronds are spoiled each year by a brown blight which absolutely destroys their beauty.

The Maidenhair is not only a wonderfully handsome, graceful fern, but it takes readily to the garden and increases each year if given a congenial soil. Its habit of putting up new fronds all during the season is particularly pleasing. The only drawback is that unless one is looking after it very carefully all the time it is apt to get eaten to a mere skeleton by slugs before one realizes that these miserable creatures are about.

Three colonies of the *Lygodium palmatum* are on their third year with me, and, up to this time, have done very nicely. They were all quite young plants when I received them, so that they are as yet rather immature.

The Hart's Tongue is a most charming fern, but, unfortunately, is not absolutely hardy in this climate. The very severe winter of 1917–18 killed a colony of large fine plants that had grown well in my garden for several years. A curious thing about this plant is that it does not seem to really start growing in good shape until just before the coming of the frosts in the autumn, at which time it is unrolling goodly numbers of thrifty fronds. Since losing my fine Hart's Tongues I bring all my plants into the house in the late fall, keeping them all winter in a cold room, where they are not subject to the extreme low temperatures. This seems to be just what they want, for they get an early start—by March—and put out beautiful big fertile fronds over twenty inches in length. So when I put them back into the garden in the spring they are much finer than any that I ever had before, and I do not have to wait all summer to see them at their best.

Although both *Woodsia obtusa* and *Woodsia ilvensis* are growing in my garden and apparently doing well, I have not had them long enough to be sure that they are absolutely established.

The three Beech ferns are easily grown and to my mind are, as a family, the most satisfactory garden ferns of the smaller sorts. They are most effective when grouped in fairly good-sized colonies, each one by itself. The Oak fern produces larger and finer fronds in my garden than any I ever saw in the wild, and the Long Beech fern does wonderfully well.

A small fern that does very nicely for me is the narrow-leaf Chain fern. Given frequent showerings with the hose, it reciprocates with fine fertile fronds, if not in too shady a spot.

The Fragile Bladder fern is one of our hardiest species and is sure to do well in the garden. It is particularly effective in the rockery. The Bulblet Bladder fern is

also very hardy and very easily grown. It is also a remarkably handsome fern and should be in every collection.

To sum up, there are over forty species of New England ferns and several Dryopteris hybrids growing in my garden, most of them doing quite well.

EXPERIMENTING.—The enthusiastic amateur in starting a fern garden is at first strongly tempted to experiment with a number of the rarer rock ferns, such as *Asplenium viride*, *Pellaea atropurpurea*, *Asplenium pinnatifidum*, etc., ferns that are extremely difficult to grow. The results are practically sure to be very disappointing, although there is some pleasure in having them growing in one's garden even for a short time.

In my opinion, however, it is much more satisfactory to confine one's attention to the ferns that are sure to do well in the particular section where the fern garden is located.

TRANSPLANTING THE FERNS.—Success in transplanting ferns from the woods to the fern garden depends on several important points. First and most important, the roots must be disturbed as little as possible. In digging most of the big ferns, such as the Osmundas, I used a grub hoe with a sharp edge, and also a long-handled spade. I dug deeply and sufficiently far away from the plant to take up plenty of soil and to disturb the roots little, if any. Aside from not disturbing the roots, this has the added advantage of bringing to the garden with the fern, plenty of the material in which it was growing and thus reproducing, to a large degree, the conditions of its native wood. The early spring is the best time to transplant, and the plants should, if possible, be taken just as the crosiers are unrolling. The ground at that time is cold and full of moisture, and ferns transplanted then hardly seem to feel the change at all.

I was quite amused to have the livery stable man remark more than once: "It does beat all, Mr. Clarkson, what bad luck you do have with the rain lately, when you hire this team." Now, the truth was that I several times selected a day of gentle rain for a collecting trip, because ferns transplanted then nearly always kept on growing without the least setback, apparently never sensing that they had been moved.

In bringing ferns to the garden, one is very apt, at first, to place them too near together, so that, as the crosiers unroll, they do not have a chance to expand without crowding each other. It really is astonishing the way the average fern will reach out as it unrolls.

A few of the finest selected ferns, with plenty of room to spread out and show to advantage, are infinitely better than inferior and crowded plants.

Although I planned originally to have only native shrubs, I found it expedient to modify this plan somewhat. For instance, the common white lilac, which does not sprout very freely from the roots, proved to be very valuable as used in clumps for shade, because it could be moved about during May and early June without wilting badly, and I sometimes found it desirable to change the amount of shade for special fern groups as the season advanced. The common purple lilac should not be used for this purpose as it sprouts freely from the roots and will spread all over the garden.

Most ferns need more sunlight than I, at least, had any idea of, but in most cases they want this sunshine for only a limited portion of the day.

Transplanting ferns during the hot days of summer is as a rule not particularly successful. If possible, ferns found at this time should be marked and moved later in the year, after the weather becomes cooler.

CARE OF THE GARDEN.—From the deciduous trees growing in the garden it receives a generous shower of

leaves in the autumn. I let many of these leaves stay on the ground, sprinkling them with sand or leaf mould to hasten their decay. This makes a good mulch to hold the moisture and also is a source of plant food, just as nature intended. It is a mistake to clear away too many leaves and old fern fronds just to "tidy up." Most ferns need plenty of moisture while maturing their fronds and an occasional thorough drenching with the fine spray from the garden hose, if the clouds do not furnish sufficient water, will do much good. If the ground is dry in the late autumn the hose should also be used, as ferns, like many other plants, will go through the winter better if the ground is full of moisture when it freezes.

SECOND GROWTH FRONDS.—Frequent rains during the summer will sometimes bring out a second growth of fronds on some, but not all, of the ferns. Because of such rains during July and August in 1918 my *Dryopteris Filix-mas*, *cristata*, *Goldiana*, *marginalis*, *spinulosa*, *intermedia*, "*Boottii*," *Cystopteris fragilis* and *D. cristata* × *marginalis* put out a new crop of fronds. It was noticeable at this time (about September 1st) that although the Broad Beech fronds were still unrolling, many of them being of a beautiful light-green color, no new fronds appeared on the Long Beech fern, which had long before this stopped growing for the season. All its fronds had lost their fresh green color and turned to a dull homely olive.

START A FERN GARDEN!—In closing this article I would urge the reader to start a fern garden, even if on a very modest scale. As an investment I can, from my own experience, guarantee that it will pay big dividends in the added health, pleasure, and intimate knowledge of the living ferns that it will surely bring to you.

NEWBURYPORT, MASS.

The Genus Aetopteron, Ehrhart

HOMER D. HOUSE

The genus Aetopteron forms No. 78 in Ehrhart's list of new genera. The type is clearly indicated to be *Polypodium aculeatum* L. No generic description is given, but the intent of the author is quite clear. Exactly parallel cases are to be found in some of the generally accepted genera published by Rafinesque (viz: Spathyema, Achroanthes, Triadenum, Scoria (Hicoria), Adlumia, etc.), which are published in the same way, without generic description, but merely by the indication of the type species.

The name Aetopteron, if adopted, and I believe that it is adequately published and should be adopted, antedates Polystichum Roth (in Roemer's Arch. Bot. 2: 106. 1799) by several years. The species of the United States thus affected are as follows:

AETOPTERON Ehrh. Beitr. 4: 148. 1789.

Aetopteron aculeatum (L.) comb. nov. (*Polypodium aculeatum* L. Sp. Pl. 1090. 1753. *Polystichum*, Roth. *Dryopteris*, Kuntze).

Aetopteron acrostichoides (Michx.) comb. nov. (*Nephrodium acrostichoides* Michx. Fl. Bor. Am. **2**: 207. 1803. *Polystichum*, Schott.)

Aetopteron braunii (Spenner) comb. nov. (*Aspidium braunii* Spenner. Fl. Frib. **1**: 9. 1825. *Polystichum*, Fée).

Aetopteron californicum (D. C. Eaton) comb. nov. (*Aspidium californicum* D. C. Eaton, Proc. Amer. Acad. **6**: 555. 1865. *Polystichum*, Underw.).

Aetopteron lemmoni (Underw.) comb. nov. (*Polystichum lemmoni* Underw. Our Native Ferns, ed. 6, 116. 1900).

Aetopteron lonchitis (L.) comb. nov. (*Polypodium lonchitis* L. Sp. Pl. 1088. 1753. *Polystichum*, Roth).

Aetopteron munitum (Kaulf.) comb. nov. (*Aspidium munitum* Kaulf. Enum. Fil. 236. 1824. *Polystichum*, Presl.).

Aetopteron scopulinum (D. C. Eaton) comb. nov. (*Aspidium aculeatum scopulinum* D. C. Faton, Ferns N. Am. **2**: 125. 1880. *Polystichum*, Maxon).

STATE MUSEUM, ALBANY, N. Y.

Recent Fern Literature

Dr. Paul W. Graff[1] has listed five ferns as previously unreported from Montana—*Ophioglossum vulgatum*, *Cystopteris fragilis*, var. *angustata*, *Aspidium cristatum*, *A. Filix-mas* and *A. spinulosum*, var. *intermedium*. These reports are based on specimens in the herbarium of the University of Montana and are accompanied by notes on the species concerned and a comparative table of their ranges in the states and Canadian provinces adjacent to Montana.

Unfortunately, Dr. Graff has overlooked a good deal of literature on Montana ferns. *Ophioglossum vulgatum* which he lists as new to the state, was reported in 1917 by Prof. M. J. Elrod as having been found at Yellow Bay, Flathead Lake (the same station cited by Dr. Graff) by Miss Bessie Green in 1914.[2] *Aspidium Filix-mas*, concerning which Dr. Graff says he has been unable to locate any definite report, was recorded by T. J. Fitzpatrick in 1904 from six Montana localities.[3]—C. A. W.

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[1] Graff, Paul W. Unreported ferns from Montana. Bull. Torr. Bot. Club **47**: 125–129. March, 1920.

[2] Elrod, Morton J. Ophioglossum vulgatum L. in Montana. Amer. Fern Journ. **7**: 125. 1917.

[3] Fern Bulletin **12**: 97. 1904.

A FRUITLESS SEARCH FOR ASPLENIUM MONTANUM IN PENNSYLVANIA.—The history of the alleged finding of *Asplenium fontanum* in Pennsylvania was fully described several years ago in the Fern Bulletin, and need not be repeated here. It has no doubt been searched for by many botanists in subsequent years, but apparently without success. The desirability of obtaining soil tests upon this species for inclusion in the writer's paper on the soil reactions of rock ferns, made a further effort to find it seem worth while. The original report gave the habitat as limestone cliffs; but there are no limestone cliffs on the Lycoming Creek, where the find was alleged to have been made. Nevertheless visits to the region were planned, starting from the town of Williamsport, which lies just east of the valley of this creek.

Cliffs of brown shale and sandstone were found to form one or the other bank of Lycoming Creek for many miles above its mouth. In summer these proved to support so abundant a growth of *Filix fragilis* and *Woodsia Ilvensis* that any *Asplenium fontanum* which might occur there would be extremely difficult to find. It was accordingly decided to make another trip in the winter, when the fronds of these obscuring species would be withered down, while the plant sought, being evergreen, would, if present at all, be in sight.

Early in January, 1920, Dr. Everett G. Logue and the writer took the trip. The stream was frozen over solidly in most places, making travel comparatively easy, and permitting access to many cliffs which were out of reach during the summer. As hoped, the *Filix* and *Woodsia* were invisible, and the only fern which could in any way (at a distance) be mistaken for the species sought was *Asplenium Trichomanes;* and a near view gave it away at once. The weather, while cold, was not unpleasant, so everything seemed to favor the finding of

Asplenium fontanum, were it really there. The results of a whole day's search were, however, negative.

The following notes may nevertheless be of interest. The soils on these cliffs showed a specific acidity ranging from 1 (neutrality) to 300, so that plants of widely different soil preferences have locally found a foothold there. Such ferns as were seen were growing for the most part in the soils of the lower acidities, from 1 to 10. It would be expected that *A. fontanum* would thrive here, for it is reported to grow elsewhere in limestone soils, where the reaction is likely to be nearly neutral. This it was possible to confirm on a specimen collected at Mt. Revard, France, by Mr. Walter Mattern, while serving with the American Expeditionary forces, and sent to Mr. Harold W. Pretz, who kindly turned it over to the writer. The soil adhering to the plant's roots showed a specific acidity of 3. The failure to rediscover this fern on the Lycoming cliffs, in spite of thorough search in apparently chemically suitable locations, made under circumstances unusually favorable, certainly suggests that if *Asplenium fontanum* ever did grow in that locality, it has subsequently been exterminated.—Edgar T. Wherry. Washington, D. C.

More Vermont Fern Lists.—Local fern lists, in competition or comparison with Mr. Winslow's Willoughby list, continue to be sent in to the Journal. The editors are very glad to receive them in any quantity and are only sorry that space does not permit printing them in full.

The two lists now at hand are both from Vermont—only Vermont, apparently, being able to compete effectively with Vermont. Mr. H. C. Ridlon sends a list of 30 species of true ferns and 4 Ophioglossaceae found within an eighty-acre area on the Charles Downer State For-

est Farm at Sharon. This list includes such of the less widely distributed species as *Polystichum Braunii*, *Athyrium angustifolium*, *Dryopteris Goldiana*, *Camptosorus* and *Cryptogramma Stelleri*, but like most local lists from the east side of the Green Mountains so far south, lacks the strongly lime-loving *Asplenium Ruta-muraria* and *Pellaea*.

Rev. C. S. Lewis sends a list of 35 species collected by him and his son, Mr. W. F. Lewis, in Manchester, Vt. This leaves Willoughby, Dorset and Manchester tied for first place and should lend excitement to fern collecting in these localities. The Dorset and Manchester lists are precisely alike, with one notable exception. Dorset has *Woodsia ilvensis* which the Messrs. Lewis failed to find; but they more than made up for it by discovering *Woodsia glabella* in considerable quantity on Mt. Equinox. This is a noteworthy extension of range for the species, the southernmost stations previously known being, so far as the editors are aware, Mt. Horrid in Rochester and Queechee Gulf in Hartford, Vt.

American Fern Society

PRESIDENT'S REPORT FOR 1919.

The reports of officers for 1919 already published have shown so completely the essential facts as to the activities of the Society during the past year that there is very little for the President to add, beyond an expression of appreciation of the generous and courteous support which has been extended by the members at all times and a brief review of our present financial situation, which undoubtedly calls for prompt remedy.

The problem of finance is, indeed, not an unusual one nowadays, either to individuals or to societies, and is a special cause of concern to those organizations which,

like our own, maintain as their chief form of activity a Journal for the advancement of their special field of study. In our own Society, the strictest economy having been practiced before, the question becomes one either of reduction in printing or of securing additional funds. Curtailment is possible in three ways: by decreasing the edition of the JOURNAL, by issuing fewer pages per number, and by omitting free illustrations. For several reasons the first method suggested is undesirable; in particular, it would result in uneven sets, which would be especially unfortunate in meeting the steady demands of the larger new membership which we expect eventually to have. As to issuing smaller numbers: Although the budget for 1920 as agreed upon contemplated publishing two 32-page numbers and two others of smaller size, if necessary, the council has hesitated to put this plan into operation, preferring to draw upon the reserve emergency fund for making up any deficit which might be incurred by the publication of four 32-page numbers, in the belief that under the present unusual conditions a more legitimate use for a part of this fund could not be found. The third suggested means of reducing expenses, by eliminating free illustrations, has been adhered to with a considerable resultant saving.

Nevertheless the day of reckoning has merely been deferred, since the emergency fund is not a large one and in any case ought not to be exhausted. Although not indispensable, illustrations are an extremely desirable feature of the JOURNAL and should be continued, the expenses being borne partly by the JOURNAL; and in other respects the JOURNAL should be continued very much as at the present time, certainly in an edition of the present size and with the present number of pages. There should be no backward steps.

Equally true it is that the costs of printing have mounted greatly, with no immediate reduction in pros-

pect, and that more money is needed if we are to continue as in the past. The necessary increase in funds might be had from an increased membership, and active new steps are, in fact, being taken just now toward bringing in new members; but income from this source will not be sufficiently large in amount or be available promptly enough to lessen the obligation of adopting some other plan. For the present, therefore, the only equitable way of maintaining the JOURNAL as it is appears to be a fifty per cent increase in the individual membership dues of our organization. We have the distinction of having held out against this solution longer than most organizations, under similar circumstances; and that this action has not been urgently required earlier is due chiefly to the efficient and disinterested services of our Treasurer and Editors and to the fact that our printers, to their distinct disadvantage, until late in 1919 held to the schedule of prices adopted in 1911. The increase in total revenues now suggested means only a small sum to the individual member, and it is hoped that the associations which the members have formed by correspondence and acquaintanceship within the Society, their deep interest in fern study itself, and their pride in helping maintain at its present level an extremely well edited JOURNAL, will be sufficient to win support for the suggested change.

Under the revised constitution of 1914 the amount of dues is fixed at $1.00, and the method of bringing about amendments to the constitution is definitely provided. Ballots covering the proposed amendments to Sections 2, 3, and 4 of Article 3 will therefore be submitted to the members by the Secretary, for vote, with the notice of the next annual election. A further amendment (Section 5 of the same Article) relates to the increase of life membership payment from $15 to $25. This change is quite as necessary as that in the annual dues, since the

life membership dues are deposited in a special fund, only the interest of which is expendable.

WILLIAM R. MAXON, *President.*

President Maxon has appointed the following committee to nominate officers for 1921: Dr. S. F. Blake, U. S. Dept. of Agriculture, Washington, D. C., Chairman, Mrs. Nellie F. Flynn and C. H. Knowlton.

The editors wish to acknowledge with gratitude, gifts for illustrations from Miss Marshall and Dr. H. D. House. They are also too much pleased with a compliment to the officers which one member has been good and encouraging enough to send in, to keep it to themselves. Here it is: "I am always pleased with the Fern Journal and think the officers of the Society produce the most with the least money of any organization on earth."

CHANGES OF ADDRESS

Badé, Dr. William F., 2616 College Ave., Berkeley, Cal.
Cheever, Dr. Austin W., 12 Avondale Road, Newton Center, Mass.
Cornman, Mrs. Leighton R., 400 Idaho Bldg., Boise, Idaho.
Darling, Miss Nancy, "Sky Farm," R. D. No. 2, Woodstock, Vt.
Greenwood, Miss Helen E., 12 Hudson St., Worcester, Mass.
Holtzoff, Mrs. Mary, 145 West 123rd St., New York City.
Lewis, Rev. Charles S., 835 Edgewood Ave., Trenton N. J.
Lewis, W. Scott, 2500 Beachwood Drive, Hollywood, Los Angeles, Cal.
Lombard, Mrs. Charles P., 92 Court St., Plymouth, Mass.
McFarland, Prof. Frank T., Dept. Plant Pathology, Univ. of Wisconsin, Madison, Wis.
Moxley, Rev. George L., 1964 East First St., Los Angeles, Cal.
Newman, Rev. S. M., care of W. W. Coon, Winthrop Place, Englewood, N. J.
Noyes, Miss Elmira E., 117 Dinwiddie St., Portsmouth, Va.
Stowell, Willard A., 41 Delawareview Ave., Trenton, N. J.
Swain, Rev. James R., 428 S. 44th St., Philadelphia, Pa.
Wertsner, Clayton S., 121 N. 15th St., Philadelphia Pa.
Young, Mrs. Charles E., Florence Court West 204, Washington, D. C.

NEW MEMBERS

Ackley, Mrs. N. C., 236 N. Kenwood St., Glendale, Cal.
Braun, Miss Lucy E., 2702 May St., Cincinnati, Ohio.
Chamberlain, Edward B., 18 West 89th St., N. Y. City.
Detmers, Miss Freda, Ohio Experm. Sta., Wooster, Ohio.
Hale, Miss Marcia E., Elizabethtown, Essex Co., N. J.
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McAvoy, Miss Blanche, Box 109 Foley Road, Price Hill Sta., Cincinnati, Ohio.
Oliver, Miss Mary H., 270 South State St., Westerville, Ohio.
Osterlund, P., 958 42d St., Brooklyn, N. Y.
Schaffner, Prof. John H., Botanical Dept., Ohio State University, Columbus, Ohio.

Mr. F. C. Greene has become a life member.

American Fern Journal

Vol. 10 OCTOBER–DECEMBER, 1920 No. 4.

FERNS OF GLACIER NATIONAL PARK, MONTANA[1]

PAUL C. STANDLEY

Glacier National Park embraces an area of 1,534 square miles in northwestern Montana along the main range of the Rockies. The region is extremely rugged and consists of a great mass of abrupt peaks, separated by deep valleys. On the north the Park adjoins Alberta and British Columbia; to the east lie the prairies of the Blackfoot Indian Reservation, and to the west the forests of the Flathead Valley. The Continental Divide traverses the Park. The streams of the west slope reach ultimately the Columbia River, and those of the east slope drain partly into the Missouri River and partly into Hudson Bay.

The highest peaks attain an altitude of little more than 10,000 feet, but the surrounding country is comparatively low—3,170 feet on the west slope and 4,800 feet on the east slope—so that the mountains are quite as imposing in appearance as the more elevated peaks of the southern Rockies. The rocks are stratified and of Algonkian age. They consist chiefly of beds of shale, limestone, sandstone, and argillite, many of which are beautifully colored in red and green.

From a scenic standpoint the region is perhaps unsurpassed in North America. There are more than 60 gla-

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[1] Published by permission of the Secretary of the Smithsonian Institute. [Vol. 10, no. 3 of the JOURNAL, pages 65–96, plate 1, was issued Sept. 21, 1920]

ciers in the Park, most of them small but nevertheless possessing all the features of the largest ones. Great banks of snow persist throughout the summer, often until late in the season even at low altitudes. There are also innumerable lakes, large and small, of beautiful shades of blue and green, some of which are found at high elevations, surrounded by banks of snow and masses of ice. Most spectacular is Iceberg Lake, whose blue surface is covered with huge blocks of floating ice fallen from the bordering glacier. The animal life also is of unusual interest and abundance. Mountain sheep and goats, bear, deer, ptarmigan, and many other mammals and birds can be seen by any visitor.

Not the least attractive feature of Glacier Park is found in the plant life. Flowers are found everywhere in the greatest profusion. Particularly is this true above and near timber line, where the meadows are solid masses of bright color throughout the summer. The heavy coniferous forests, especially those of the west slope, are also of great interest.

The Continental Divide, as is well known, is an important factor in plant distribution, and this fact is strikingly exemplified locally in Glacier Park. The flora of the east slope is that generally characteristic of the mountains of Wyoming and Colorado. The trees are lodgepole and limber pine, alpine fir, Engelmann spruce, Douglas fir, aspen, and black cottonwood. On the west slope the flora shows a close relationship to that of the Pacific Coast. Here we find all the trees which grow on the east slope, and in addition the western white and yellow pines, western larch and hemlock, grand fir, giant cedar, and paper birch. All these are typical Pacific Slope species, and most of them reach the eastern limit of their range here. The herbaceous plants also illustrate the differences between the floras of the two slopes, but not in so striking a fashion. The Pteridophyta,

however, whose species are likely to have a wider distribution than those of flowering plants, are practically the same on both slopes, except in the case of the genus *Lycopodium*, most of whose species are confined, apparently, to the west slope.

Of the life zones recognized by biologists, four are represented in Glacier Park, as follows:

Transition Zone. On the east slope this includes the plains and the narrow strips of land which extend up the creek valleys; also the more exposed slopes of the lower mountains. On the west slope the zone is represented by limited areas of yellow pine timber that lie along the North Fork of the Flathead River. The vegetation of the plains region consists of herbaceous plants, largely grasses, and of a few low shrubs. Pteridophyta are rare; the only ones which really belong in the zone, probably, are *Equisetum arvense* and *Selaginella densa*.

Canadian Zone. This covers the largest portion of the Park, including all of the heavily timbered area. Open hillsides and meadows in the heavy timber are frequent, especially on the east slope. The trees are the species enumerated above, and there is a large representation of shrubby and herbaceous plants. Most of the ferns are found in this zone, and a large proportion of them do not occur elsewhere.

Hudsonian Zone. The Hudsonian Zone is an ill-defined belt about timber line (6,000 to 7,500 feet), which is a transition area between the forests of the Canadian Zone and the meadows and barren slopes of the Arctic-Alpine Zone. The trees are chiefly white-bark pine and alpine fir. These occur mostly as low, stunted, scattered individuals, but they are sometimes assembled in dense thickets. Frequently they assume the "krumholz" form. The species of herbaceous plants are very numerous, but few are confined to this zone. Pteridophyta found here are *Adiantum*, *Cryptogramma acros-*

tichoides, *Athyrium americanum*, *Polystichum Lonchitis*, *Filix fragilis*, *Woodsia scopulina*, and *Equisetum arvense* and *E. variegatum*. None of these, except perhaps the maidenhair, is confined to the zone.

Arctic-Alpine Zone. Here belong all the slopes which lie above the last remnants of trees. There are a few low shrubs, chiefly willows, but most of the plants are small herbs, many of them with remarkably brilliant flowers. The vegetation is extremely interesting. A large number of the species represented have a wide distribution in arctic and alpine regions of the Northern Hemisphere. The following Pteridophyta grow here: *Botrychium Lunaria*, *Asplenium viride*, *Cryptogramma Stelleri*, *Athyrium americanum*, *Lycopodium Selago*, and *Equisetum variegatum*. All of these, except possibly *Asplenium viride*, are found in more or less abundance at lower altitudes.

There seems to be a general belief among visitors to Glacier Park that few ferns are found in the region, but examination of the accompanying list will show that such an impression is an erroneous one. Only a few of the species, it is true, occur in great abundance, but the total number is certainly large for an area of this size in the western United States.

The list of species here presented is based upon a collection made by the writer during the summer of 1919. Nearly ten weeks were spent in the Park, under the direction of the National Park Service, for the purpose of obtaining data concerning the flora. During this time all the portions of the Park usually seen by tourists were visited, and a collection of approximately 4,000 numbers was obtained, representing over 900 species of flowering plants and vascular cryptogams.

The ferns of Montana have been listed by Fitzpatrick[1]. Thirty-seven species were reported, a smaller number

[1] Fern Bull. 12: 97–101. 1904.

than that reported here for Glacier Park. The species listed from Montana but not found by the writer in the Park are *Botrychium Coulteri*, *Asplenium Trichomanes*, *Pellaea glabella*, *Marsilea vestita*, *Equisetum scirpoides*, and *Isoetes Bolanderi*. Of these, the *Botrychium*, *Asplenium*, and *Equisetum* were collected by R. S. Williams at Columbia Falls, only a few miles from Belton, and they are almost certainly to be found in the Park.

OPHIOGLOSSACEAE

Botrychium virginianum europaeum Ångstr. Found chiefly at middle altitudes. The plants are usually scattered and many of them are sterile. The first ones seen by the writer were found by Miss Gertrude Norton in woods about Lake McDermott. Scattered plants were collected later on mossy banks in swampy woods below the lake. In an open bog on a slope along the road near Many Glacier Hotel there must have been hundreds of them, of all sizes. They grew in deep moss under scrub birches and willows, with *Habenaria dilatata* and *Parnassia fimbriata*. On the west slope the plants are often larger than on the east slope. Here they are found in swampy thickets in deep woods. Individuals growing in the open were yellowish green, while those in the woods were deep green.

Botrychium silaifolium Presl. Rare; a few small plants in sphagnum bog at Johns Lake; larger ones along Swiftcurrent Creek below Lake McDermott, in a wet thicket near beaver runs, under willows and *Rhamnus alnifolia*.

Botrychium Lunaria L. Rare; seen only on the east slope; a few isolated plants found on grassy slopes, in bogs, and on mossy banks in deep woods. Collected by Williams at St. Mary Lake. The only locality at which the species was found in abundance was on the moraine at Grinnell Glacier, where there were dozens or hundreds

of the plants, of all sizes, growing on bare soil among rocks, where there was little other vegetation. Probably the plants are not rare at middle elevations, but they are so small and so hidden among other vegetation that they are not easily found.

POLYPODIACEAE

Polypodium hesperium Maxon. Occasional on the east slope at middle or rather low altitudes; infrequent on the west slope; in crevices of shaded argillite cliffs and on mossy boulders in deep woods. The plants seldon occur in any considerable quantity, and in dry places they are small and shriveled. The rhizomes are sweet and have a flavor like that of licorice.

Adiantum pedatum aleuticum Rupr. Not common, but found in several places above or near timber line, in crevices of argillite and limestone cliffs; a few plants found on the west slope at Avalanche Lake, growing in a log jam at the foot of the lake, doubtless carried down by water from some more elevated station. All the plants seen were decidedly small. Their habitat is very different from that of the maidenhair as it is commonly found in the eastern and central states. The plants seem to be almost confined to the Hudsonian Zone, a distribution which must be rather unusual in the western United States. Piper gives the zonal distribution in Washington as Humid Transition and Canadian. Fernald, however, states[1] that the plant is alpine in the Gaspé Peninsula of Quebec, and it appears to be arctic in some portions of Alaska. There is a fine colony of the plants along the cliffs beside the trail just below Iceberg Lake.

Pteridium aquilinum pubescens Underw. Common nearly everywhere in the wooded regions, but usually not extending to the upper limit of timber; in thin or dense woods, in wet thickets, or on open, rather dry slopes. In

[1] Rhodora 7: 190–192. 1905.

open places and in thin woods and thickets the plants are small and yellowish green, while in wet shaded localities they are larger, bright green, and less pubescent. Some of the plants in swamps about Lake McDonald were over five feet high. In late summer the leaves turn yellow or brown.

Cheilanthes siliquosa Maxon. (*Pellaea densa* Hook.) Rare, apparently; found by the writer only on an open slope among loose rocks just above Many Glacier Chalets; collected by Williams in the Lake McDonald region. An unattractive plant, with large loose tufts of brittle leaves.

Cheilanthes gracillima D. C. Eaton. Frequent at middle altitudes, on exposed argillite and limestone cliffs, forming loose tufts. This species has been reported from the Park by Jones as *C. Feei* Moore.

Cryptogramma acrostichoides R. Br. Frequent at middle altitudes, and occasionally extending above timber line; on argillite and limestone cliffs, but most commonly found on rock slides, half hidden among the rocks. Although the plants grow normally in rather dry situations, in excessively dry weather they soon shrivel. They usually form small isolated tufts, which are conspicuous because of the absence of other vegetation.

Cryptogramma Stelleri (Gmel.) Prantl. Occasional above timberline, in crevices of wet shaded cliffs. Here the plants are small and they never occur in abundance. They suggest an immature stage of some larger fern, and are likely to be overlooked. The finest display of this species was seen at Baring Falls, near Going-to-the-Sun Camp. Here, on the overhanging cliffs, which are kept constantly moist from the spray of the falls, there were hundreds of large plants, growing in loose moss, associated with saxifrages and *Mimulus*. The plants have a pale green, sickly appearance. Some of them were attacked by a rust, determined by Dr. J. C. Arthur as *Hy-*

alopsora Cheilanthes (Peck) Arth. Near Grinnell Glacier *Cryptogramma Stelleri* was found in association with *C. acrostichoides.*

Athyrium Filix-femina (L.) Roth. (*A. cyclosorum* Rupr.) The most common fern of the Park, found nearly everywhere in the wooded regions; most abundant in deep moist woods or thickets, but occurring also in thin woods, along streams, in swamps, and on moist open slopes. Probably nine-tenths of the ferns seen in the Park are of this species. In deep woods they often form a dense continuous undergrowth of large interlacing fronds, and on wet slopes, among alder thickets, the plants often cover the ground to the exclusion of most other vegetation. The lady fern is so abundant that one soon comes to look upon it as a weed and to have scant regard for any attractive features it may possess. In favorable situations the fronds are often five feet high. They vary greatly in shape and breadth. In shade they are bright green, but in open places they have a yellowish tinge. In the open the fronds are held more stiffly erect than in protected places. The sori, also, vary conspicuously in form; usually they are merely curved, but those of some plants are horseshoe-shaped. Many of the leaves are covered in late summer with irregular dark spots, which are probably caused by some fungus. The lady fern is often associated with the oak fern, male fern, lace-flower (*Tiarella*), arnicas, twisted-stalk, and red baneberry.

Athyrium americanum (Butters) Maxon. Frequent above timber line; on open grassy slopes, along brooks, on rock slides, and sometimes in cliff crevices. This species is very unevenly distributed; in some places above timber line it is very abundant, in others rare, and in many places absent. It is perhaps the finest fern of the region, and one of the most conspicuous. The fronds are usually about a foot high, and they form mass-

es one to three feet across, which are so dense that there does not appear to be space for the growth of a single additional frond. These clumps are usually surrounded by dense turf or by bare rock, so that they have almost the appearance of having been carefully planted and tended. The leaves always have a fresh, somewhat yellowish green color; they have a slight balsamic odor. This fern is plentiful at Grinnell Glacier and Sperry Glacier and above Lake Ellen Wilson. At Sperry Glacier it is more abundant than elsewhere. Near Sexton Glacier only two or three clumps were noticed, and it was equally scarce between Morning Eagle Falls and Piegan Pass. Near Grinnell Glacier a few plants grew in cliff crevices with the maidenhair. The display of this fern along the trail above Lake Ellen Wilson was particularly striking, for here the great clumps were placed among loose rocks of deep red argillite, which formed a delightful contrast with the pale green fronds.

Asplenium viride Huds. Above timber line at Iceberg Lake and Cracker Lake, in crevices of moist cliffs; collected along the Garden Wall at Granite Park by Miss Gertrude Norton. In a few places this species occurs in some abundance, but it seems to be rare. Our plants are rather small. The fronds lie close against the rocks and are not at all conspicuous.

Polystichum Andersoni Hopkins. Rare; found only at Grinnell Lake and along the upper trail from Many Glacier Hotel to Piegan Pass. In both localities it grew, in some abundance, in dense moist alder thickets on steep hillsides, with the lady fern and male fern. It is a handsome plant, with its fine vigorous fronds held rather stiffly erect. The old withered fronds fall over and persist at the base of the plant. This species has been collected previously only in Washington and British Columbia.

Polystichum Lonchitis (L.) Roth. Frequent at middle altitudes, and often extending above timber line;

usually in deep moist woods, but sometimes found in open places at high altitudes, or on cliffs. Although the holly fern is widely scattered, it is unusual to find more than a few individuals in any locality. It is rather generally distributed on the east slope and at higher elevations on the west slope, but it was not noticed about Belton or Lake McDonald. The plants vary greatly in size. Those of high altitudes are often very small. About timber line they grow mostly under stunted pines and firs and other shrubs, seldom venturing far from some protection. In places plants were seen growing so far back in holes in cliffs that it was difficult to see how they could ever obtain any moisture.

Dryopteris Linnaeana C. Chr. (*Phegopteris Dryopteris* Fée). Common in deep woods of fir, spruce, hemlock, giant cedar, etc.; chiefly at middle altitudes. The oak fern is abundant in many places. Usually it is associated with *Dryopteris Filix-mas* and *Athyrium Filix-femina*, but frequently it grows alone, densely covering mossy banks, or forming a thin ground-cover in the densest forest. The plants are very sensitive to dryness, and in 1919 many of them withered in late summer. Frequently the leaves are disfigured with dark spots, which may be the result of fungus action. The fronds vary greatly in size. It is this species, presumably, which has been reported from the Park by Jones as *Phegopteris polypodioides*.

Dryopteris cristata (L.) Gray. Rare; seen only at Johns Lake (just above the head of Lake McDonald), growing under bushes in sphagnum at the outer edge of the bog. The plants were not very numerous.

Dryopteris dilatata (Hoffm.) Underw. Common at middle altitudes, especially on the west slope; usually in moist woods or thickets or along brooks; sometimes in the less wet portions of sphagnum bogs. This is usually associated with the lady fern, and in general appearance the two are not very conspicuously different.

Dryopteris Filix-mas (L.) Schott. Common at middle altitudes; in deep moist woods or in wet thickets. The plants are large and luxuriant and often make a fine display. They are usually of a deeper green than the lady fern, with which they usually grow.

Filix fragilis (L.) Gilib. Common at all altitudes except the highest; growing in diverse habitats—on shaded or exposed cliffs, on moist banks in woods or along streams, on mossy boulders in woods, and sometimes on rock slides. It is often associated with *Woodsia scopulina*, and some forms of the two species are much alike in general appearance. It is the only fern, except possibly *Pteridium*, which grows about the east entrance. Sometimes the plants are erect, but on cliffs they are often pendent. In dry weather they soon turn yellow and wither. This fern is rather common in moist places above timber line.

Woodsia scopulina D. C. Eaton. Common on the east slope at middle and high altitudes; on the west slope occuring at rather high elevations; growing on cliffs or rock slides. The plants attain their best development on rock slides, where they often form large dense clumps of erect fronds. The stipes persist for many years about the bases of the plants.

Woodsia oregana D. C. Eaton. Collected on rocky hills at the east entrance by Umbach (no. 274). This species is not represented in the collections made by the writer, although there is no reason to believe that it is rare in the region. No attempt was made in the field to distinguish W. *scopulina* and W. *oregana*, but the writer expected that both species would be represented in the rather numerous collections obtained. It may be W. *oregana* is confined to the lower altitudes, where the writer spent little time in making collections.

LYCOPODIACEAE

The genus *Lycopodium* is well represented in the Park, but only one of the species was seen below timber line on the east slope.

Lycopodium Selago L. Local; above timber line just below Sperry Glacier, rather common under bushes and in the shade of rocks; also in similar situations at Gunsight Pass; very abundant at Johns Lake in sphagnum. At Johns Lake the plants grew chiefly under bushes near the edge of the bog, in low mounds of a densely tufted, reddish sphagnum (*S. fuscum*). The species seems to belong to the Arctic-Alpine Zone, for although Johns Lake lies at a low altitude, some of the plants found here (notably *Kalmia microphylla*) grow elsewhere only above timber line.

Lycopodium alpinum L. Found only at Snyder Lake; occurring rather sparingly just at the edge of a rock slide, under blueberry bushes. This species is not known to have been collected in the United States previously. It is considered an Arctic plant, but at Snyder Lake it was growing in the Canadian Zone. When seen from a short distance, it bears a striking resemblance in habit and color to the creeping cedar (*Juniperus horizontalis*).

Lycopodium obscurum L. Seen only near Belton, along the road from the railroad station to Lake McDonald; growing in moss in deep woods of larch, Douglas fir, hemlock, and western white pine.

Lycopodium annotinum L. Common at middle and low altitudes on the west slope, and occasional at middle altitudes on the east slope; in dense woods or thickets. This is the most widely distributed species of *Lycopodium* of the Park, and in some places it is very abundant. Frequently it forms large mats of loose stems. Many of the plants on the west slope are unusually large.

Lycopodium complanatum L. Frequent on the west slope at low altitudes; trailing over the ground in dense

woods. Most of the plants seen were sterile. The species is well distributed about Belton and Lake McDonald, but it does not appear to extend to much higher elevations.

Lycopodium clavatum monostachyon Hook. & Grev. Seen only at Johns Lake, where it is very abundant in moist thickets just outside the sphagnum bog. It is a handsome plant, very different in color and form from our other species.

SELAGINELLACEAE

Two species besides those listed below occur in the Park. The plants are found in open places nearly everywhere on the east slope, at all altitudes, and they occur in greater abundance than in any region known to the writer. Species of *Selaginella* are rare or absent on the west slope.

Selaginella Wallacei Hieron. Common or abundant at low and middle altitudes, and sometimes above timber line, on open, grassy or rocky slopes, on dry hilltops, and in dry meadows.

Selaginella densa Rydb. Common at low altitudes, especially on prairie. On the dry, rocky flats about St. Mary this is one of the most common plants, densely covering large areas of ground.

EQUISETACEAE

Equisetum sylvaticum L. Rare on the east slope, found only in a boggy place in woods at the edge of Lake Josephine, growing with *E. variegatum;* occasional on the west slope at middle altitudes in boggy places in woods. Very different in appearance from any other species; sometimes forming dense tangled masses.

Equisetum arvense L. Common, and often abundant, at nearly all altitudes except the highest; in wet meadows or thickets or along streams and lake shores; frequent on rocky slopes or in wet gravelly meadows above timber

line. Some of the plants found above timber line, especially in the vicinity of snow banks, are nearly prostrate and very sparsely branched. This species is common about the east entrance, extending out upon the prairie. It seems to thrive particularly well upon railroad embankments, and a thick stand of the plants is often seen growing from dry gravel and cinders.

Equisetum litorale Kühl. Occasional at low altitudes, in wet ground or boggy thickets.

Equisetum palustre L. Rare, apparently; a few plants at Belton in sand along the river.

Equisetum variegatum Schleich. Common, especially at middle altitudes and above timber line; about pools, on lake shores, along streams, and in wet meadows or thickets, often in sand or gravel. It is especially abundant in the meadows above or near timber line, and frequently forms dense, almost pure stands of decumbent or ascending stems. Often it is seen growing up to the edges of snow banks. Sometimes it occurs about cultivated ground at low altitudes.

Equisetum fluviatile L. Frequent at low and middle altitudes; in marshes, bogs, or swamps; in sphagnum bog at Fish Lake. The stems are long and weak and occasionally prostrate. In the marshes along Swiftcurrent Creek below Lake McDermott this species is very abundant, growing in shallow water and forming dense pure stands. The stems are of a deep bright green, and at a short distance they strongly suggest those of *Scirpus occidentalis*.

Equisetum praealtum Raf. Occasional at low altitudes, in willow thickets or on rocky lake shores.

Equisetum kansanum Schaffner. Found only at the foot of Sherburne Lake, along a small gully in aspen woods.

Equisetum hyemale L. Common at low altitudes, in swamps or wet thickets; occasionally found on open, well-drained banks.

WASHINGTON, D. C.

Aetopteron as a Generic Name

JOHN HENDLEY BARNHART

It was indeed startling to read in the last number of the American Fern Journal (**10:** 88) that there was an earlier valid name for *Polystichum*. To me, at least, it was still more startling to read the assertion concerning Ehrhart's name *Aetopteron:* "The type is clearly indicated to be *Polypodium aculeatum* L. No generic description is given, *but the intent of the author is quite clear*" (italics mine). Evidently the writer of these words failed to observe that Ehrhart carefully explains his intent.

Ehrhart prepared and distributed a set of exsiccatae under the title "Phytophylacium," and inserted in his Beiträge (**4:** 145–150. 1789) a list of the species (ten decades, or one hundred in all). Each species in the list is assigned a single name, followed by its current binary one. At the end of the list is the following explanation; the translation here given is rather free, but I believe closely approximates the sense of the original: "I must here omit, for lack of space, the locality where each plant was collected. I have reprinted, however, my 'nomina usualia'. Not that it seems to me to be of very much consequence, since they are nothing but an attempt to assign to each plant a name, that may be used for it alone, without an accompanying generic one, as suggested by Oeder in his 'Einleitung zur Kräuterkenntniss,' §141; but that a certain man by the name of Dahl, who is a particular friend of the idea, might derive some amusement from it, and that I might accomodate him."

The suggestion of Oeder,* mentioned above, may be freely translated as follows:

"There may be proposed, for common non-botanical conversational use, names which we may call nomina

*Oeder. Elementa botanicae 134. 1764.—I have not seen the German translation cited by Ehrhart.

'usualia,' always independent names. having no connection or relation to classification, to genus, or to specific relationship, but one for each species, relating to itself alone. It will be permissible, then, for species known by these 'nomina usualia' to be arranged freely by botanists in their respective systems and transferred at will, to be associated in genera and to be re-classified, for under all these changes of methods each name would remain unchanged."

Under these circumstances it appears to me that "the intent of the author *is* quite clear," but this intent is certainly not to publish or even to suggest *Aetopteron* as a generic name. The mere fact that Ehrhart's list of a hundred plants includes fourteen mononomial designations for as many species of *Carex* ought to be sufficient to suggest extreme caution in interpreting the significance of these names, even if his explanation were overlooked.

In view of the comparatively small number of plant species then known, it is a little strange that Oeder's suggestion did not meet with wider acceptance. As far as I am aware it was never tried out by anyone except Ehrhart, and by him only in this one instance. Many years afterward Aubert du Petit Thouars used a somewhat similar method, apparently thought out quite independently, applying mononomials to each species of Madagascar orchids, but his attempt attracted no imitators.

The number of names that would be required for the vast throng of species now recognized renders the use of such a method at the present time wholly impracticable. Yet there are doubtless many of us who would hail with delight any equally simple but practicable scheme for divorcing nomenclature from taxonomy.

NEW YORK CITY.

What the Latin Names Mean—I.

In a late number of the JOURNAL, the suggestion was made that amateur members of the Society might be interested in getting the meanings and application of the Latin specific names of ferns. In accordance with this suggestion, the following list of specific and varietal names now in use for our northeastern ferns, with their interpretations, has been prepared. If there is sufficient indication that it meets a long-felt want, the editors will endeavor to provide similar lists for the fern allies and for other sections of the country.

Unmistakable geographical names, like *virginica* and *americana*, have been omitted. It is to be understood that all such expressions as "of cliffs," "of woods" and the like, refer to the kind of place in which the plant in question grows, or was supposed to grow by the author who gave it its name. "Lat." stands, of course, for Latin; "Gr." for Greek.

C. A. W.

acrostichoides—Gr., like *Acrostichum*, a genus of tropical ferns in which the sporangia are not gathered into separate sori, but cover the whole under surface of the fertile fronds or segments.

alpina—Lat., alpine.

anadenium—Gr., glandless.

angusta—Lat., narrow.

angustifolium—Lat., narrow-leaved.

angustisegmentum—Lat., with narrow divisions; referring to the sterile frond.

aquilinum—Lat., of an eagle; referring to the pattern, like a heraldic eagle, formed by the vascular bundles when the stem of the bracken is cut across near the base—a detail noted as long ago as 1550.

areolata—Lat., with small spaces or meshes; referring to the pattern formed by the veins.

atropurpurea—Lat., dark purple: referring to the color of the stipe.

attenuatum—Lat., gradually narrowed: referring to the shape of the segments.

auritum—Lat., eared; referring to the projecting lobes at the base of the pinnae which suggest in shape the ears of an animal.

Boottii—named for William Boott, 1805–1887, a well known New England botanist who collected the type specimens.

Boschianum—for Roelof Benjamin van den Bosch, 1810–1862, a writer on the filmy ferns.

Bradleyi—for Professor F. H. Bradley, who sent to D. C. Eaton the specimens from which the species was described.

Braunii—for Alexander Braun, 1809–1877, professor at the University of Berlin and a student especially of cryptogamic plants.

bulbifera—Lat., bulb-bearing; referring to the well-known habit of one of the bladder ferns.

cambricum—Lat., of Wales (of which Cambria was the ancient name), this form having apparently been first observed in that country.

Capillus-Veneris—Lat., Venus' hair; probably a translation of an ancient name for the plant.

Cathcartiana—for Miss Ellen Cathcart who collected the type specimens.

celsum—Lat. high, lofty, elevated; perhaps because this fern was first found growing on mossy stumps and logs, or possibly referring to the tall fronds.

cinnamomea—Lat. cinnamon-colored; referring to the sporangia.

Claytoniana—for Dr. John Clayton, 1685(?)-1773, one of the earliest of American botanists.

Clintoniana—for G. W. Clinton, 1807-1885, an amateur botanist of Buffalo, N. Y.

compositum—Lat. compound; referring to the more numerous divisions of the sterile frond.

concordiana—from Concord, Mass., where the plant was first found.

cristatum—Lat. crested. Usually employed for forms in which the fronds or pinnae branch repeatedly near the apex, thus forming a tassel-like cluster at the end.

dealbata—Lat. whitened; referring to the white covering of the under surface of the frond.

densa—Lat. crowded together; referring to its habit of growth or to the crowded segments.

dilatata—Lat. expanded; referring to the large size of the lowest pinnae.

dissectum—Lat. cut into many segments.

Dryopteris—Gr. oak or tree in general, and fern; perhaps referring to the woodland habitat of the plant.

dubia—Lat. doubtful—an epithet which should need no explanation to anyone who remembers his first attempt to name a plant.

ebenoides—Gr. resembling *Asplenium ebeneum*.

elongatum—Lat. lengthened.

Engelmanni—for Dr. George Engelmann of St. Louis, 1809–1884, author of studies of American oaks, rushes, cacti, etc.

Feei—for Antoine Laurent Apollinaire Fée of Strasburg, 1789-1874, a noted writer on ferns.

Filix-femina—Lat. female or lady fern; probably a translation of the popular name.

Filix-mas—Lat. male fern; probably like the preceding, a translation of the popular name.

fragans—Lat. sweet-smelling, the fronds of the fern concerned being fragrant.

fragilis—Lat. easily broken, brittle.

frondosa—Lat. leafy; referring to the green sterile segments which appear among the fertile ones in this form.

The Society for the Prevention of the Wild.

BY C. E. WATERS.

Years ago when a branch of the Wild Flower Preservation Society was established in Baltimore, one facetious feminine member nicknamed it the Society for the Prevention of the Wild. Everyone of us who has botanized or pursued any other branch of natural history in a particular locality for more than two or three years will begin to think that such a society exists there. Perhaps the writer of this jeremiad is unduly pessimistic, for he began to feel this way in the early days of the Fern Chapter and long ago expressed in print an unfavorable opinion of modern improvements which are responsible for the destruction of the wild places.

My acquaintance with the botany of the Baltimore region began late in 1890. During the years since then there have been many changes brought about in one way or another. To consider only the plants in which this Society is interested, there have been some losses, possibly irreparable. To own up at the start, before telling what others have done, my first and only plant of *Asplenium ebenoides* was enthusiastically grabbed up

and its fronds removed. Too tardy compunction led me to stick the roots back into the ground, but the damage was a double one and the plant died. For several years I would periodically search for the plant near a certain big rock, but in vain.

Perhaps others like myself have had the feeling that it is right to collect all the plants we need for our herbaria and for exchanging. We are too apt to forget that the plants will be dead and gone, no matter how scientifically they may be collected.

This brings me quite naturally to the large number of specimens of *Asplenium Bradleyi* that are in my herbarium. With them grew *A. montanum*, but very sparingly. Even my devastating hand did not take all of the plants, but there were none to be seen four or five years ago. The place became known to too many botanists, for the ferns were rare and interesting enough to induce them to take the trip on the railroad or, what was better, a tramp of twenty miles or so.

One other rare fern, to my knowledge, has been exterminated from the Baltimore region. *Lygodium palmatum* once grew in profusion in a little swamp beside the Baltimore-Washington turnpike. As late as 1902 fruiting plants three and four feet tall could be seen there. Ten years later two of us spent a long time looking, but did not see a single plant of any size.

In more than one manual *Botrychium simplex* is said to be found in the Baltimore region. Mr. Edgerton, who made the original discovery near Ellicott City on the Patapsco River, told me years ago that the plants were in one corner of a pasture. Of course the cows stood in that corner in preference to any other. The fern is no longer to be found near Ellicott City.

The only station for *B. neglectum* was not a stone's throw from a house. Suburban improvements have been the death of the dozen or so plants. A few acres

of woodland through which were scattered numerous large rocks on which grew an abundance of *Cheilanthes lanosa*, have also been improved out of existence.

In Anne Arundel County, only a few miles from Baltimore, there is a stream which flows through woods and past farms. At one place it broadens out into a shallow pond, now almost filled with silt. In the early nineties my schoolmates and I made several attempts to find this pond, because *Sarracenia* and other interesting plants grew around it. Now the pond can be seen from a much traveled road because truck-growers have cleared off nearly all the woods. Some of the plants which are in danger are *Dryopteris simulata* and *Lorinseria areolata*, both of which grow in large beds, *Anchistea Virginica*, one of two plants of *Dryopteris Boottii* known to be near Baltimore, and *Lycopodium adpressum*, not to mention many flowering plants. This is the type locality for *Osmunda cinnamonea glandulosa*.

Possibly none of the above would have been written if it had not been for a walk which my boy and I took on Decoration Day. He wanted to take, and perhaps brag about, a twelve-mile walk, and I wished to revisit one of the wildest and loneliest and most interesting haunts of the days before my coming to Washington. The first seven miles had the peculiarity so often noticed that although the contour lines on the map showed a drop of over one hundred feet, yet all the hills ran up, and were very steep at that. At the very spot where we had intended to take an obscure path across the hill to the banks of the Gunpowder River, we saw the first of a series of signs announcing that this was a state game preserve. The penalty was too large to encourage taking a chance at trespassing. Even now, six months later, I have not gotten over the disappointment of that moment, because for nearly thirty years the woods on both sides of the river had been my favorite haunts.

Baltimore gets its water from the river, and a few years ago it became necessary to erect a new and much higher dam. This improvement was bad enough, because the higher water covered my only colonies of fringed gentian, of *Lycopodium claratum* and of a curious depauperate form of *Dennstedtia punctilobula* which B. D. Gilbert, against my protest, named var. *nana*. Drowned also are two patches of ostrich fern, one of them the first reported south of Pennsylvania.

Now that the Water Board has put several square miles of land under the protection of the State Conservation Commission, many other plants are safe even from botanists. No doubt it is all for the best, but it is cold comfort to think so. And it is hard to think so when I remember the fox grape vine more than five inches in diameter, which it was a pleasure just to look at. Near by was a group of papaw trees, the only ones on which fruit could be found every year, and one of three colonies of *Filix fragilis*. The other two are farther down the river, one in a rocky ravine and the other on a steep grassy bank. Judging by the shape and habit of the fronds, and having no knowledge of intermediate forms, one would be almost justified in calling them distinct species.

Across the river, on rocks that lie in the full blaze of the sun, is the only *Selaginella rupestris* known near Baltimore. This moss-like plant was identified for me by a professor of mathematics in the University of Bonn, then lecturing in Baltimore. That was on Thanksgiving Day, 1893. He was rather disgusted to find that the countryside was not dotted with inns, because he had brought no lunch with him, and mine was not enough for two. We stopped at a farmhouse where they gave us bread and preserved tomatoes. These were eaten on the doorstep while a flock of turkeys looked on. I never learned whether or not he had turkey that evening for a late dinner.

Growing with the *Selaginella* are the largest plants of *Cheilanthes lanosa* I have seen. In January, 1891, our high school "Chapter" of the Agassiz Society took a tramp (nobody "hiked" in those days) of twenty miles or so and found the dead fronds. Not for ten years or more was the fern found in two other places miles away.

After all this gloomy writing I feel but little better, even though I know that it is not my fault that all of these things have happened. If there is any moral at all to this, it is that we should think at least twice before we destroy a rare plant by collecting it in quantity. The Society should have for one of its objects the protection of our ferns. By giving too much encouragement to collecting and exchanging it can too easily become a Society for the Prevention of the Wild.

WASHINGTON, D. C.

ASPLENIUM GRAVESII IN PENNSYLVANIA.—While engaged in the study of the soil reactions of rock ferns the writer went through the herbarium of Mr. Harold W. Pretz of Allentown, Pennsylvania, to obtain data on rare species there included. Among specimens of *Asplenium pinnatifidum* which had been collected in a ravine along the lower Susquehanna River, just below Fites Eddy, Lancaster County, Pa., on August 31, 1913, there were found to be several showing a gradation in their features toward *A. Bradleyi*. They appeared to correspond to the description of the hybrid between these two species named *A. gravesii* by Mr. W. R. Maxon about two years ago[1]; and on comparison with the type of the latter plant in the National Herbarium, complete identity was established.

The sheets of *Asplenium pinnatifidum* and *A. Bradleyi* from the lower Susquehanna region in the herbarium

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[1] Am. Fern Journ. 8: 1. 1918.

of the Academy of Natural Sciences of Philadelphia were then examined, and at least six specimens agreeing more or less definitely with this hybrid were found to be there included. They came from McCall's Ferry, Cully and Muddy Run, in Lancaster County, and from York Furnace in York County, across the river. These localities all lie in an area less than 20 kilometers long by 3 km. wide. It is noteworthy that both parents of the hybrid are present at all of the places just listed; and although *A. Bradleyi* was not observed by Mr. Pretz at the locality from which his specimens came, it grows in the general vicinity.

The chief features on which the identification of this hybrid were based are tabulated here, with the corresponding data for the parent species.

TABLE 1. COMPARISON OF THE FEATURES OF THREE ASPLENIUMS

	A. pinnatifidum	*A. gravesii*	*A. Bradleyi*
Stipe	green, often brown below	brown, rarely green above	brown throughout its length
Frond	pinnatifid to pinnate	pinnate, pinnatifid above	pinnate throughout
Rachis	broad, green	fairly broad, green: often brown below	narrow; lower half brown, upper half green
Margin	crenulate	crenate-dentate	serrate
Texture	thick	medium	thin
Sori	pale brown	dark brown	dark brown

In spite of a rather considerable variability of the above three ferns, the hybrid can be readily recognized in practically every case, the dark brown sori, brown stipe, and intermediate degree of cutting of the margin being the most striking features.

Tests made upon the soil adhering to the roots of *A. gravesii* in several of the herbarium specimens mentioned and subsequently at the actual localities (visited in July 1920), have shown the specific acidity of 100 to 300 in every case. It is noteworthy that these values are

the same as characterize the two parents, showing that, as in another instance mentioned in the writer's recent paper on rock ferns in this journal, the hybrid does not differ from the parents in soil preference.—EDGAR T. WHERRY, WASHINGTON, D. C.

Recent Fern Literature.

Glandular hairs are not infrequent on the outside of ferns, as of other plants, but it is probably news to most of us that they occur also inside. Dr. Theodor Holm has described and illustrated[1] such hairs which he found in the leaf-tissue of certain species of Dryopteris. If a cross-section of a leaf in these species be examined under the microscope, the tissue is found to be much more compact near the upper and lower surfaces. The cells there are closely contiguous; in the central part of the leaf, however, there are occasional air-spaces between them. In these spaces the glandular hairs are found. DeBary had long ago discovered such hairs in the ducts of the root-stock and the lower part of the petiole in *Dryopteris Filix-mas* and *D. spinulosa*, but they seem not to have been hitherto observed in the leaf. Dr. Holm found them in *D. Filix-mas*, *D. marginalis*, *D. spinulosa* and *D. cristata*, but not in *D. Thelypteris* nor *D. noveboracensis*, nor in representatives of seven other genera of our North American ferns which he examined. Nor are they known from any other plants whatsoever. Internal hairs have been noted in Pilularia and in four families of flowering plants, but in these cases they are not glandular.

Dr. Holm points out that the presence of these singular structures in certain species of the genus Dryopteris, as at present defined, and not in others, tends to confirm

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[1] Holm, Theo. Internal glandular hairs in Dryopteris. Rhodora **22**: 89–91, figs. 1 and 2. May, 1920.

Mr. Christensen's expressed belief that the species of the marsh fern group and those of the shield fern group really constitute separate genera.

Some time ago, in reviewing Dr. J. K. Small's "Ferns of tropical Florida," the present writer remarked that the chief regret of the fern lover who goes South would be that the author had not extended that work to cover the whole of the state. He has now done so to the extent of giving, in a brief article, a more or less complete list of the species known to occur within its boundaries and a general account of their habitats and distribution.[2]

In all about 90 species are mentioned, though Dr. Small states that more than one hundred have actually been found. Three, *Pycnodoria* (*Pteris*) *longifolia*, *Dryopteris setigera* and *Marsilea vestita*, are introduced; seven are found only in Florida. The remainder Dr. Small divides into two main groups, northern species whose range extends from Florida northward or westward along the Gulf of Mexico, and tropical species which reach Florida from the south. The former comprises about one third of all the species and most of those widely distributed within the state. The latter, though twice as numerous, are for the most part confined to two comparatively limited areas—the keys of the coast and the Everglades, treated in Dr. Small's earlier work, and the lime-sink region in the northwestern part of the peninsula, which has figured in the pages of the JOURNAL.[3] The latter is an isolated area in which the occurrence of tropical ferns is not easy to explain.

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[2]Small, John K. The land of ferns: the habitats and distribution of the fernworts of Florida. Journ. Elisha Mitchell Sci. Soc. **35**: 92–104, pls. 24–28. 1920. Reprinted as no. 222 of the Contr. N. Y. Bot. Gard.

[3]See M. A. Noble. Fern Hunting in Florida in the phosphate country. Amer. Fern. Journ. **6**: 42–44. 1916 and R. M. Harper, The Fern Grottoes of Citrus County, Florida, Amer. Fern. Journ. **6**: 68–81, pl. 5. 1916.

Dr. Small's article is illustrated with five fine plates of a fern grotto and of various species in their natural surroundings.

American Fern Society

Dr. O. E. Jennings, Judge of Elections for this year, reports the results of the October balloting as follows. All the proposed amendments to the Constitution were adopted, the first three by 96 votes for to none against, the fourth by 95 for and one against. The vote for officers was: for President, William R. Maxon, 104; for Vice-President, Miss M. A. Marshall, 103, Mrs. Carlotta C. Hall, 1; for Secretary, Stewart H. Burnham, 104; for Treasurer, J. G. Underwood, 104. Eight members who voted for officers failed to vote, either pro or con, on the amendments.

The editors wish to make grateful acknowledgment of a generous gift of ten dollars from Mr. F. C. Greene for the general purposes of the JOURNAL and of smaller, but none the less welcome, gifts for illustrations from Miss Anne S. Angell, Miss Annie Lorenz, Miss Nellie Mirick and Dr. Herman Burgin.

The Society has recently received the gift of six volumes of the *Fern Bulletin* from Dr. Ruth Marshall; also six numbers of the *Bulletin* from Prof. S. Fred Prince and a copy of the rare number three of volume one of the JOURNAL. Mr. Carl Christensen has presented copies of four of his recent papers, *New Species of Hymenophyllaceae from Madagascar*, *Monograph of the Genus Dryopteris, Part II*, *The Pteridophyta of the Juan Fernandez Islands* and *The Ferns of Easter Island*. The last two were written in collaboration with Dr. Carl Skottsberg. All of the four are, or soon will be, available for lending to members.

New members:

Cleveland, Mrs. Frederick, 70 Winter St., Norwood, Mass.
Morrill, Mrs. Frank A., 87 Walpole St., Norwood, Mass.
Patterson, Miss Roberta M., 422 Randolph St., N. W., Washington, D. C.

Changes of address:

Anderson, Miss Flora C., 327 South Henderson St., Bloomington, Ind.
Angell, Miss Anne S., McVeigh Farm, R. D. No. 1, Brattleboro, Vt.
Burnham, Stewart H., Dept. of Botany, College of Agriculture, Ithaca, N. Y.
Cornman, Mrs. L. R., Camp Kearney, San Diego Co., Cal.
Fellows, Dr. Dana W., 7671 Amboy Road, Tottenville, Staten Island, N. Y.
Stratton, Mrs. G. H., 439 Rebecca Ave., Wilkinsburg, Pa.
Wilcox, Prof. Alice W., Brennan College, Gainesville, Ga.

Miss Pauline Kaufman, 173 East 124th St., New York City, wishes to sell the following: *Fern Bulletin*, 1898 to 1901, 1903 to 1905, 1908 to 1910, all inclusive: *Fern Bulletin* for 1902, July number missing, and for 1906, no 4 missing; FERN JOURNAL for 1911 complete and for 1912 with no. 3 missing.—Adv.

As indicated in the report of the Judge of Elections above, membership dues are now, by vote of the Society, $1.50 per year. Please remit promptly; do not wait to hear from the Treasurer. An advance in the price of back numbers of the JOURNAL will take effect February 1st, 1921.

The JOURNAL is very late this time; the editors feel, however, that the apologies which are undoubtedly called for should come, not from them, but from the post office department, which lost, mislaid or stole the manuscript for this number en route to the printer.

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ERRATA

Page 58, caption. For 85, read 58.
Page 63, line 5. For principle, read principal.
Page 90, line 1. For MONTANUM, read FONTANUM.
Contents of no. 2, line 5. For 60, read 59. Line 7. For 78, read 61.

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E. J. WINSLOW C. A. WEATHERBY

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American Fern Journal

Vol. 11 JANUARY–MARCH, 1921 No. 1.

Notes on American Ferns—XVI.[1]

WILLIAM R. MAXON.

SELAGINELLA HUMIFUSA Van Eseltine. This name, recently given by Van Eseltine[2] to a species of central and southern Florida allied to *S. arenicola* Underw., is, unfortunately, invalidated by *S. humifusa* Hieron., applied several years earlier to a plant from Borneo.[3] The Florida species may therefore be known as **Selaginella floridana** Maxon, the type being *Nash* 1449, from the vicinity of Eustis, Lake County, July 16–31, 1894. *Selaginella floridana* is known otherwise from specimens collected near Sanford, Orange County, in September, 1902, by S. Rapp, and in the vicinity of Alapattah, Dade County, by A. A. Eaton.

LYCOPODIUM OBSCURUM L. This species, as *L. dendroideum* Michx., was reported from Sand Mountain, in Jackson and De Kalb counties, Alabama, by Mr. Graves in the JOURNAL for July–Sept., 1920, upon specimens collected by himself. An earlier Alabama collection, apparently never reported, is of material in the Mohr Herbarium (in the National Herbarium) collected in boggy open situations 7 miles from Mentone, De Kalb County, October 13, 1900, by Miss Inez Loring. The specimens were presumably received by Dr. Mohr too late to permit listing this species in the Plant Life of Alabama.

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[1]Published by permission of the Secretary of the Smithsonian Institution.

[2]Contr. U. S. Nat. Herb. **20:** 165. *pl. 18. text fig. 65.* 1918.

[3]Hedwigia **51:** 257. 1911.

[Vol. 10, No. 4 of the JOURNAL, pages 97-128, was issued Feb. ,7 1921.]

LYCOPODIUM SITCHENSE Rupr. According to material in the National Herbarium, the range of this species must be altered to read: Alaska to southeastern Labrador and western Newfoundland, south to Oregon, Idaho, the northern shore of Lake Superior, northern New York (Adirondack Mountains), New Hampshire (Mount Washington), and Maine (several localities, including Mount Katahdin). The western range has long been known to include Washington, numerous specimens being at hand from the region of Mount Rainier, Stevens Pass, Mount Paddo (Adams), and the Olympic Mountains, at altitudes of 1,200 to 2,100 meters. The Oregon record, which appears to be new, rests on a single specimen from the shore of Amabilis Lake, Calapoaia Mountains, August 9, 1897, *Corille & Applegate* 496. The Labrador record is authenticated by a specimen collected at St. Michaels, in August, 1891, by Waghorne (no. 7a). In British Columbia, Washington, and Oregon, *L. sitchense* is found almost exclusively in wet mountain meadows, while in the east it occurs in various habitats, reaching its best development in upland spruce woods and thickets.

LYCOPODIUM ANNOTINUM L. This species is known from northeastern Washington (*Kreager* 412) and the region of Mount Rainier (*Piper* 2110, *Flett* 2014), but is not mentioned by recent writers as occurring in Oregon. There is at hand, however, an excellent specimen collected at the base of Mount Hood, Oregon, in October, 1884, by Thomas Howell, properly determined and labeled in his hand. It belongs to the typical form of the species.

In the eastern United States, Pennsylvania is commonly given as the southern limit of this species. It was collected in the mountains of Garrett County, in extreme western Maryland, as long ago as 1875, however,

by Capt. John Donnell Smith, as shown by two specimens in the National Herbarium.

PTERETIS NODULOSA (Michx.) Nieuwland. An unidentified specimen of this species was included in a collection of plants from the Queen Charlotte Islands recently sent to Prof. C. V. Piper, of the U. S. Department of Agriculture, for examination. The label indicates that it was collected at Skidegate, by C. F. Newcombe, in August, the year uncertain. *P. nodulosa* is usually attributed to British Columbia, but it is evidently rare in that region, and it seems worth while to publish a record of this specimen, a portion of which has been added to the National Herbarium. Since this species is not known to occur in Alaska, the present specimen appears to represent the northwestern limit of its range.

PELLAEA LONGIMUCRONATA Hook. Additional Colorado specimens of this species are at hand from Mr. John P. Young, who collected them at Canyon City, August 12, 1919. The only other Colorado material known to the writer is that collected at the same locality by Brandegee nearly fifty years ago, a specimen of this collection being in the D. C. Eaton Herbarium.

DRYOPTERIS ARGUTA (Kaulf.) Watt. This plant of the Pacific coast region, which has usually been known as *Dryopteris rigida arguta* (Kaulf.) Underw., differs widely from the European *D. rigida* and is very clearly entitled to the specific rank reaccorded it by Watt in 1866.[1] It is, however, frequently confused with *D. filix-mas*, not only by collectors but in the herbarium as well. The firm, strongly convex indusium of *D. arguta*, with its deep, narrow sinus and glandulose margins, has commonly been regarded as a distinguishing character, the indusia of *D. filix-mas* ordinarily being thin, orbicular-reniform, and glabrous; but the marginal

[1] Canad. Nat. II. 3: 159. 1866.

glands are not always easily seen in mature specimens of *D. arguta*, and plants of *D. filix-mas* growing in exposed situations often show firm indusia very similar to those of its near ally. Distinctive differences are, however, found in the foliage characters, which may be stated briefly as follows:

Pinnae sessile, oblong-lanceolate, the lower basal pinnule usually with a semicordate base, this overlying the primary rachis: veinlets spreading, all ending in salient spinelike teeth.
D. arguta.

Pinnae mostly short-stalked, deltoid-lanceolate, the basal pinnules symmetrical, distinctly apart from the primary rachis; veinlets oblique, fewer, ending in oblique, usually curved teeth, these merely acute.....*D. filix-mas.*

Dryopteris arguta is a very common species of rocky ravines and partially shaded slopes in southern California, whence it extends northward (chiefly in the coastal and interior valley regions) to western Oregon and the bluffs of the Columbia River above Cathlamet, Washington, in the Upper Sonoran and Transition zones. Its reputed occurrence in British Columbia is extremely doubtful. *Dryopteris filix-mas* extends from Newfoundland to British Columbia, south to Vermont, South Dakota, extreme western Oklahoma, New Mexico, Arizona, Nevada, and Oregon, being restricted apparently to the Canadian and Hudsonian zones. It occurs also at a single locality in California,—Holcomb Valley, San Bernardino Mountains, altitude 2,400 meters, August 3, 1882, *S. B. & W. F. Parish* 1613,—as reported long ago by Mr. S. B. Parish. A specimen of this collection is in the Dudley Herbarium of Stanford University.

WASHINGTON, D.C.

The Soil Reactions of the Ferns of Woods and Swamps.

EDGAR T. WHERRY

The ferns to which this essay is devoted are on the whole less sensitive to soil acidity and alkalinity than those which grow on rocks, to which attention was directed in a previous paper.[1] It seems worth while, however, to place on record what data have been obtained on testing the soils surrounding their roots by the indicator method. The introductory and explanatory portions of the paper cited apply sufficiently well to the present one to make their repetition unnecessary. The data are presented in similar form, although a slightly different method of classification seems desirable, for additional types of reaction-range are represented. The following designations are used in the class column of table 1:

AA, intensely acid; appearing to thrive only in medi-acid soils.

A, acid; growing well in soils of practically all degrees of acidity.

I, indifferent (relatively); appearing to thrive in both acid and alkaline soils, so long as neither reaction is extreme.

C, calcareous or circumneutral; growing best in neutral soils, though extending throughout what is termed the circumneutral range (specific acidity 10 to alk. 10). No instance has been found of a species which will not grow in neutral or slightly acid soils as well as in actually alkaline ones.

In the last column the geographic range is described by S for southern, N for northern, and a dash,—, when the species is wide-ranging.

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[1] Amer. Fern Journ., **10:** 15–22, 45–52, 1920.

TABLE I. SOIL REACTIONS OF FERNS OF WOODS AND SWAMPS.

Name	No. of Tests	REACTIONS: Mediacid	Subacid	Minimacid (Circumneutral)	Minimalkaline (Circumneutral)	Subalkaline	Class	Range
		300+	100 30+	10 3+	1 3+	10 30+		
Schizaea pusilla	10	X	– –	– –	– –	– –	AA	S
Lygodium palmatum	10	X	x –	– –	– –	– –	AA	S
Osmunda regalis var. spectabilis	30	X	X X	x x	– –	– –	A	–
cinnamomea	30	X	X X	x x	– –	– –	A	–
Claytoniana	20	x	X X	X X	X x	– –	I	–
Pteretis nodulosa	20	–	– –	x X	X X	x x	C	N
Onoclea sensibilis	30	x	X X	X X	X X	x –	I	–
Dennstedtia punctilobula	30	x	X X	X X	X X	x –	I	–
Woodwardia areolata	20	X	x –	– –	– –	– –	AA	S
virginica	20	X	X X	X x	– –	– –	A	S
Pteridium latiusculum	30	X	X X	X x	– –	– –	A	–
Adiantum pedatum	30	–	– x	X X	X X	x –	C	–
Polystichum acrostichoides	30	x	X X	X X	X X	x –	I	–
Braunii	10	–	– x	X X	X X	x –	C	N
Athyrium angustifolium	10	–	– x	X X	X X	x –	C	–
acrostichoides	10	–	x X	X X	X X	x –	I	–
asplenioides	30	x	x X	X X	X X	x –	I	S
angustum	10	x	x X	X X	X x	– –	I	N
(Dryopteris = Aspidium; includes Phegopteris)								
Dryopteris Thelypteris	30	X	X X	X X	X X	x –	I	–
simulata	10	X	x –	– –	– –	– –	AA	S
noveboracensis	30	X	X X	X X	X x	x –	I	–
Linnaeana	20	–	x X	X X	X x	– –	I	N
Phegopteris	20	x	x X	X X	X X	x –	I	N
hexagonoptera	30	–	x X	X X	X X	– –	I	S
marginalis	30	–	x X	X X	X X	x x	I	–
Goldiana	10	–	– –	x X	X x	x –	C	–
var. celsa	10	X	– –	– –	– –	– –	AA	S
Filix-mas	(2)	–	– –	– –	X X	– –	C	N
cristata	20	x	X X	X X	X X	x –	I	–
var. Clintoniana	(2)	–	– –	X –	X –	– –	I	–
spinulosa	20	X	X X	X X	X X	x –	I	–
var. intermedia	20	X	X X	X X	X X	x –	I	–
var. americana	3	–	– –	X –	– –	– –	A	N
× Boottii	20	X	X X	X X	X X	x –	I	–
marg. × crist	10	–	– x	X X	X X	x –	C	–

Totals: AA, 5; A, 5; I, 18; C, 7; sum, 35.

Features of Individual Species.[1]

The soils of the curly grass fern, *Schizaea pusilla*, have been tested at three localities in the New Jersey Pine Barrens, at all of which it grows in damp sand together with a short stemmed sphagnum. The reaction proved to be mediacid in all cases, and it is to be classed as a typical intensely-acid soil plant. Its relative the climbing fern, *Lygodium palmatum*, has been similarly studied in New Jersey and in Maryland just east of the District of Columbia, the same reaction being found. This plant is much more widespread than the curly grass, and may be tolerant of a somewhat less degree of acidity; but for the present both are placed in the same class.

The American royal fern, *Osmunda regalis* variety *spectabilis*, and the cinnamon fern, *O. cinnamomea*, are apparently identical in occurrence and soil requirements. They thrive best in sphagnum swamps, and tests of their soils there have shown, of course, high degrees of acidity. They also grow in damp woods where more or less leaf mold has accumulated, and tests of such localities in Pennsylvania and adjoining states have shown reactions ranging down to minimacidity. They are therefore classed as acid soil species. The interrupted fern, *Osmunda Claytoniana*, while found in the same general places as the two preceding, grows best in the leaf mold and is only exceptionally found in sphagnum. It is, moreover, abundant in calcareous glacial drift soils in northern New Jersey and Pennsylvania where the reaction has been found to reach a slight degree of alkalinity. It is accordingly classed as relatively indifferent.

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[1]The nomenclature used here follows the 7th edition of Gray's Manual, with most of the changes urged by Mr. Weatherby (Rhodora, **21**: 173-179. 1919; also **22**: 80. 1920). In order to aid readers who do not have the literature at hand, and who of course will not find the new names in any previous text-book or other compilation on ferns, old and more or less well-known synonyms are added in many cases.

The ostrich fern, *Pteretis nodulosa* (formerly considered an *Onoclea*, then *Matteucia*) is best developed in alluvial soils and on damp limestone ledges, and its soil reaction does not vary much from neutrality. Near Lake Willoughby, Vermont, a subalkaline reaction was observed once, but minimalkaline was the rule. Along the Potomac river in Virginia just northwest of the District of Columbia it grows in sand kept nearly neutral in reaction by frequent inundation by the calcareous river water, and it does not spread far into the more acid upper levels. In its occurrence in the mountains of West Virginia the soil is very slightly acid, and it is regarded as a typical circumneutral soil plant. The sensitive fern, *Onoclea sensibilis*, is on the other hand a plant of wide reaction range. While not common in sphagnum swamps, it does grow in fairly acid soils; yet it seems to thrive just as well in limestone regions, where the waters are minimalkaline. It is accordingly placed in the indifferent class.

The hay-scented fern, *Dennstedtia punctilobula* (once classed as a *Dicksonia*) does not appear to have any marked preferences as to soil reaction. It often grows in sandy woods, although there thriving best on slopes where soils of somewhat diminished acidity approach the surface. It has even been observed in mediacid peat in the Dismal Swamp, in southern Virginia. On the other hand it grows on limestone ledges and in leaf mold accumulated on other rocks, where minimalkaline reaction may develop, and is to be regarded as a typically indifferent species.

The narrow-leaved chain fern, *Woodwardia areolata* (also known as *W. angustifolia*, and often placed in a different genus, *Lorinseria*) abounds in the New Jersey Pine Barrens, in sandy swamps east of the District of Columbia, in the Dismal Swamp, etc., where the reaction is almost uniformly mediacid. The same reaction

was found to characterize a swamp in the mountains north of Slatedale, Pennsylvania, where it was discovered, far from its usual Coastal Plain surroundings, by Mr. Harold W. Pretz. Experiments in the writer's garden have shown it to be readily killed by applications of calcareous (Potomac river) water. It is evidently an intensely-acid soil species. The broad-leaved chain fern, *Woodwardia virginica* (sometimes placed in the genus *Anchistea*) thrives best in mediacid sphagnum swamps and bogs, being in fact a pernicious weed in the cranberry bogs of southern New Jersey. It tolerates a decidedly lower degree of acidity than does the preceding species, however, having been observed in waters of as low as minimacid reaction in glacial drift near Allentown, Pennsylvania (Pretz), in the New Jersey Marl area and in the region around Cape Henry, Virginia. It is accordingly classed as merely an acid soil plant.

The common brake, *Pteridium latiusculum* (*Pteris aquilina* of old) grows in great abundance in the New Jersey Pine Barrens and elsewhere in the Coastal Plain sands, and might be supposed to be an intensely-acid soil plant. Its root system lies at a considerable distance beneath the surface, however, and is often surrounded by material of only moderately acid reaction. It seems quite definitely to avoid limestone, although in the vicinity of St. Johnsbury, Vermont, it has been observed to grow in calcareous glacial drift, of but minimacid reaction. It has also been found in the District of Columbia in red clay soils of this low acidity, and is to be classed as tolerant of all degrees of acidity.

The maiden-hair fern, *Adiantum pedatum*, thrives best where leaf mold of circumneutral reaction accumulates, and grows also in soils containing limestone fragments, exhibiting slight alkalinity. It appears to avoid the more acid soils, and is classed as a circumneutral

soil species. The writer has not had the opportunity to study the Venus' hair fern, *A. Capillus-Veneris*, in the field, but descriptions of its habitats indicate that it falls into the same class.

The Christmas fern, *Polystichum acrostichoides*, is about as nearly indifferent to soil reaction as a plant can be. It grows alike in the mediacid sands of the Coastal Plain, in decaying wood in the Dismal Swamp, in leaf mold, and in the alkaline soils over limestone ledges. The most luxuriant plants, however, appear in the soils of intermediate reactions. Braun's Holly fern, *P. Braunii*, seems to be rather more limited in its soil preference. It has been studied in the vicinity of Lake Willoughby, Vermont, and at its southernmost known station in Ganoga Glen, Luzerne County, Pennsylvania. In the former region the rocks are decidedly calcareous, and the soils neutral or slightly alkaline; in the latter locality the rock is a red sandstone, and the soils slightly acid. The plant thus falls into the circumneutral soil class.

The narrow-leaved spleenwort, *Athyrium angustifolium* (formerly classed as an *Asplenium;* also known as *A. pycnocarpon)* is most common in limestone regions, in practically neutral or somewhat alkaline soils. In Virginia just northwest of the District of Columbia it grows in neutral river sand, but also extends up the bank into soils of slightly acid reaction. On the whole, however, its relations suggest it to be a circumneutral soil species. The related silvery spleenwort, *Athyrium acrostichoides* (also formerly an *Asplenium;* once *A. thelypteroides*) is decidedly more wide-ranging, thriving in subacid soils as well as in minimalkaline ones; it is accordingly classed as indifferent.

The lady-fern group (*Asplenium Filix-Foemina* of old) has now been subdivided into two species, *Athyrium asplenioides* and *A. angustum*, which may perhaps be

best distinguished as the lowland and highland lady ferns respectively. The lowland species, which is common on the Atlantic Coastal Plain and on the Piedmont Plateau, has a very wide range of soil preference. In the extreme acid sands of the Coastal plain it does not thrive so well as in subacid soils; but it is decidedly luxuriant in limestone regions too. The highland lady fern, so called because it is best developed in the Allegheny Mountains and in the New England hills, is also rather wide ranging. Though apparently most luxuriant in practically neutral soils it was noted to grow all through the Presidential Range, White Mountains, New Hampshire, often well above the tree line, and extending almost to the summit of Mt. Washington. As the soils became more acid, on ascending these mountains, the fern became smaller in stature, and even where conditions as to moisture content, shade, etc., were apparently favorable, it did not seem to thrive. On the other hand, neither was it found to do well in calcareous glacial drift. Both of these species are classed as indifferent, although they and their varieties deserve further study.

The remaining ferns to be described all belong to the large genus or group of which the synonymy is shown in the table. The marsh fern, *Dryopteris Thelypteris*, is wide-ranging, growing about equally well in acid bogs and in meadows watered by limestone springs. It is classed as indifferent. The "Massachusetts fern," *D. simulata*, has been observed only in swamps in Maryland east and northeast of the District of Columbia, the soils being mediacid in all cases. Further study may show it to have a wider range, but for the present it may be classed as an intensely-acid soil plant. The New York fern, *D. noveboracensis*, is, however, about as wide ranging as the marsh fern, and is similarly classed.

The beech fern group, formerly placed in a separate genus *Phegopteris*, but now included under *Dryopteris*,

are all about alike in soil preference. The oak fern, *D. Linnaeana* (*Phegopteris Dryopteris*) has not been observed in the most acid soils, and thrives best in those of such low acidity, or even slight alkalinity that it is placed in the circumneutral soil class. The long beech fern, *D. Phegopteris*, is more wide ranging, growing, though greatly stunted, in the acid soils above the tree line on Mt. Washington, New Hampshire; being most luxuriant in glacial drift of very slightly acid reaction; but doing well even on limestone ledges. It is classed as indifferent. The broad beech fern, *D. hexagonoptera*, grows in a somewhat more restricted range of conditions, but does sufficiently well on both the acid and alkaline sides as to be placed in the same class.

The marginal-fruited fern, *D. marginalis*, grows on rocky slopes, and might have been included in the former paper (which treated of rock ferns). It is very wide ranging as far as reaction is concerned, though not observed in typically mediacid soils. A minimacid reaction seems to suit it best, but it also thrives in decidedly alkaline soil on limestone ledges, and it is classed as indifferent.

Goldie's fern, *D. Goldiana*, is a rather typical circumneutral soil plant, having been found in Virginia and Vermont in soils of at most minimacidity, in Maryland and Pennsylvania in minimalkaline limestone soils. The variety or subspecies known as *celsa* is on the other hand a plant of intensely-acid soils, growing most luxuriantly throughout the Dismal Swamp, Virginia, where mediacid reactions are practically universal.

The male fern, *D. Filix-Mas*, has not been studied by the writer in the field. In certain nurseries it thrives in minimacid soils, and the soil in which it grows in one source of their supply, the mountains of Colorado, has been found to be practically neutral. A soil sample kindly sent to the writer by Miss Nancy Darling from

the colony of this fern in Hartland, Vermont, proved to be minimalkaline. It is therefore classed as a circumneutral soil plant, although more tests should be made upon it.

The crested fern, *D. cristata*, has a decidedly wide range of soil reaction, growing rarely in the New Jersey Pine Barrens and in the Dismal Swamp, Virginia, in mediacid soils (though not really thriving there) and, at the other extreme, occurring on damp limestone ledges in eastern Pennsylvania. The most luxuriant plants the writer has seen were growing in the slightly acid muck along a stream flowing through mica-schist rock in Maryland northwest of the District of Columbia. It is classed as indifferent. The variety known as Clinton's fern, var. *Clintoniana*, has not been studied in the field, but there is no reason to doubt its essential similarity in soil requirements to the typical form. Samples of its soil kindly sent to the writer by Mr. C. A. Weatherby from a maple swamp in Avon, Connecticut, gave minimacid reactions; and one sent by Miss Inez A. Howe from St. Johnsbury, Vermont, proved to be neutral.

The spinulose fern, *D. spinulosa* and the variety *intermedia*, are as far as observed identical in soil requirements, both being wide-ranging. The typical form was observed above the tree line on Mt. Washington, New Hampshire, in mediacid soil; while in the calcareous soil regions of central Vermont it seemed to avoid the soil proper and grew on hummocks of decaying vegetable matter where the acidity was also high. It is common in the acid Dismal Swamp, Virginia. On the other hand it has been found in eastern Pennsylvania to grow on limestone ledges, where the soil reaches minimalkalinity, and can only be regarded as on the whole an indifferent plant. The variety *intermedia* is occasional in mediacid soil on the Coastal Plain and in

the mountains of eastern Pennsylvania, though growing, like the species, on limestone, and evidently to be classed as indifferent also. The var. *americana* (formerly known as *dilatata*)has been tested near Lake Willoughby, Vermont, and there appears to favor slightly acid soils.

Two of the hybrids of species of *Dryopteris* have been studied as to soil acidity, the so called Boott's fern, *D. Boottii*, in Vermont, Pennsylvania, and Maryland, and the well-marked hybrid between *D. marginalis* and *D. cristata* in Pennsylvania and New Jersey. The former grows on everything from sphagnum hummocks to limestone ledges, and is evidently indifferent. The latter, however, has not been observed in soil of greater acidity than subacid, and may provisionally be classed as a circumneutral soil plant.

In the article on rock ferns already referred to, it was remarked that further study would no doubt result in extending somewhat some of the ranges of reaction recorded; and it seems of interest to record here one instance of this. The ebony spleenwort, *Asplenium platyneuron*, was classified as a calcareous soil plant rather tolerant of acidity, but stated not to have been observed in typically mediacid soils. It has since been found to grow with remarkable luxuriance in mediacid decaying wood in the Dismal Swamp, Virginia. A capital X, if not a bold-face one, should accordingly be placed in the 300 column in the table on page 17 of that article. This species thus becomes the widest-ranging rock-fern thus far recognized, (though really a woods-fern at the most acid extreme). The class should be changed, to indifferent.

From the foregoing discussion it will be seen that the ferns of woods and swamps are on the whole less particular than the rock ferns as to their soil reactions; and in but a single case, *Dryopteris Goldiana* and its variety *celsa*, are closely related plants sharply contrasted in

optimum reaction. It is, however, noteworthy, that the peculiar relation found to exist among rock ferns,—the favoring of acid soils by southern species and of circumneutral soils by northern ones,—is likewise well marked in the present series of plants. As the same sort of relation appears to hold also with other plants than the ferns,—in particular with the native orchids,—it is sufficiently definite to justify inquiry into its probable origin.

Circumneutral reactions are shown by soils which either: contain considerable amounts of undecomposed carbonate minerals; are bathed by alkaline spring waters; or are so situated as to favor the accumulation of leaf mold. An acid reaction, on the other hand, tends to develop in soils which either: lack carbonate minerals; are exposed to the action of rain water so that basic constituents become leached out; or are so located that peat can accumulate.

In northern latitudes, or at high elevations, rocks disintegrate more rapidly than they decompose, and so, if the rocks at any locality thus situated contain suitable minerals in the first place, circumneutral soils may develop. Glacial deposits are especially likely to contain undecomposed carbonate minerals, which the ice has ground from rock ledges; and actual tests of the soils derived from such deposits, in Pennsylvania, New Jersey, and the New England states, have shown that even after exposure to the weather for many thousands of years, since the last ice-sheet retreated, sufficient quantities of undecomposed minerals are still present in many places to keep the reaction circumneutral.

The territory left bare by the retreat of the great ice-sheet must at first have presented an almost unbroken expanse of circumneutral soils, and the vegetation which first occupied it accordingly comprised only plants which thrive best in such soils. Although acid soils

have developed subsequently in many places, and permitted invasion by plants adapted to growth under acid conditions, a considerable number of the original occupants still persist, and are today classed as "northern" species.

In more southern regions, on the other hand, decomposition usually outstrips disintegration, so that soils containing undecomposed carbonate minerals are relatively rare. Except where limestone outcrops, or where leafmold accumulates, therefore, the dominant soil reactions are inclined to be acid, and the plants, established there since long before the glacial period, have become adapted to growth in such soils. The favoring of circumneutral soils by northern species, and of acid soils by southern ones, is thus connected with the geological history of the respective regions.

WASHINGTON, D. C.

More About Early Days of the American Fern Society.

C. E. WATERS.

In the second number of this JOURNAL for 1919, was an interesting article by E. J. Winslow on "Early Days of the Fern Society." It brought back a host of pleasant memories and made me feel like a historical character. Most historical characters did whatever they became notorious for a long time ago, and they are almost invariably dead ones.

It does seem like a long time since the summer of 1887 when, a boy just out of grammar school, I spent a summer in the Pennsylvania mountains east of Altoona. There a botanist friend showed me that it was possible to become acquainted with the ferns and wild flowers

without the tiresome school lessons in botany over which my sisters groaned. In 1893 my qualifications for membership in the nascent Fern Chapter of the Agassiz Society were not great, and it never entered my head that so many years later my fingers would be busy tapping out these reminiscences. My one fear then was that Mr. Clute might not accept my application for membership, but there need not have been such a fear. It has been my experience that most societies of this sort are only too eager to get new members and their dues, and on one or two occasions our Treasurer has even dunned me for mine.

Proud as we were when our articles appeared in the Bulletin, we did not think that the day would come when libraries and herbaria would try to get complete sets of them, but even that has happened. Then we were greatly pleased when our scientific papers with their labored attempts at "fine writing" appeared on those tiny pages. We may wish now that some of these had not been written, but of the Bulletin as a whole we need not be ashamed. Even if it had contained no contributions of value, it would still have been worth while, for it helped the members to form friendships by correspondence if not by actual acquaintance. It was a place where those who needed help could make known their difficulties and feel pretty sure that somebody could help them. One such question led to working up an analytical key based on the stipes, just to see if it could be done. This led to the unexpected conclusion that the stems are not only very characteristic, but their features are subject to less variation than the leafy parts of the fronds. With practice one can get to recognize stems from which all the pinnae have been stripped, provided the scales are left on.

It has not been my fortune to be acquainted with many of the members, but the memories of three or four

of the older ones who are no longer with us will always be pleasant. Two visits to the home of B. D. Gilbert will not be forgotten, nor will one or two talks with the jovial L. M. Underwood. Somehow it seemed a most surprising thing that Geo. E. Davenport should be an art dealer in Boston. During one visit to his store he spoke of Asa Gray in terms of deep affection, while tears came to his eyes. He was anxious to get a living plant of a glandular form of *Osmunda cinnamomea* which had recently been found near Baltimore. I think my first communication with him was in 1894, a week or two after the appearance of the number of the Botanical Gazette in which he described the new *Dryopteris simulata*. Two months before, in October, I had found great beds of it near Baltimore and, unable to decide between *D. thelypteris* and *D. noveboracensis*, had kept two fronds. One of these was pronounced by Davenport to be typical. With such confirmation there could be no doubt about there being a large colony, perhaps two or three acres in extent, far beyond what might be called the normal range of the species. As to the *Osmunda*, which has been found in New Jersey and Mississippi and must occur elsewhere on the Coastal Plain, Davenport was interested in finding out whether it would retain its glandular pubescence in cultivation. He died the year after the plant was sent to him, so that I never learned about how his plants behaved.

This suggests a word of caution to those who are new students of ferns. It is never a thing amiss for them to have their "finds" verified if the fern they think they have belongs to a difficult genus or is very far out of its recognized range. Even the commonest things are misnamed. One correspondent who agreed to send me several species once forwarded as many different forms of *Athyrium asplenioides* (*filix-foemina*). Recently a correspondent, who with his wife has been in-

terested in ferns for five or six years, sent me a lot of living plants of *Woodsia obtusa* for *W. ilvensis*. Just a look at the stems would have prevented this mistake, for even the manuals mention the obscure joint near the base of the stipe of the latter species.

Things did not always run smoothly, and there were critical moments when some of us hardly knew "where to get off." The detailed account of these moments should remain in the unwritten history of the Society, because peace was made after each period of hostilities, and probably the majority of the members did not know there had been any altercations. Indeed, there are but few members left from the early days. The list of May, 1920, shows just eight who joined in 1895 or before, and only 36 more who came in between that year and the end of 1902. This total of 44 is not a large proportion of the "flourishing society of one hundred or more members" which Mr. Winslow discovered in that year. It is a much smaller proportion of the 264 in the latest list.

WASHINGTON, D. C.

The Ferns of Baltimore and Vicinity.

C. E. WATERS

In this JOURNAL for April-July, 1919, is an account of the ferns of the District of Columbia, by W. R. Maxon. By putting in the proper place names and making some few other changes, his account would do very well for the Baltimore region. The geological features are much the same and the difference in latitude, as well as in altitude, is so slight that there are few species on either list which are not on the other. It will not be necessary, therefore, to repeat all the names but only to point out the differences or to comment on particular species.

In 1837, Dr. Wm. E. A. Aikin published a catalog of the plants found in the vicinity of Baltimore. In 1888, Basil Sollers, a most enthusiastic amateur well known to the writer, published a "Check List of Plants" found in the same region. In this list are all the plants mentioned by Aikin, as well as those in Ward's "Flora" of the District of Columbia, because the latter were to be looked for near Baltimore. My account includes data from Aikin and from Sollers.

OPHIOGLOSSACEAE.

Ophioglossum vulgatum L. Found in only a few places and always in damp woods. It has never been seen in the open grassy situations where it is so frequently found in New England.

Botrychium virginianum (L.) Swartz. The dwarf fruiting forms, 4 or 5 inches high, which were ill-advisedly called *B. gracile* Pursh, occur in places where the conditions appear not to be the most favorable.

Botrychium obliquum Muhl., var. *oneidense* B. D. Gilbert. This was found two or three times in wet soil in thick woods.

Botrychium neglectum Wood. The discovery of three or four dozen plants east of Towson, Balto. Co., was a definite extension of the southward range of this fern, unless the fern found by Egerton near Ellicott City, Howard Co., and called *B. simplex*, was really *neglectum*. The plants found near Towson were in a little thicket at the edge of open woods.

Botrychium simplex E. Hitchcock. See note above. The writer was told by Egerton that the few plants were in the corner of a field in which cows were pastured, so that the station was destroyed.

OSMUNDACEAE.

Osmunda regalis L. Plants growing in dense shade have pinnules much resembling the leaflets of the honey locust.

Osmunda cinnamomea L., var. *glandulosa* Waters. The type locality is near Glen Burnie, Anne Arundel Co., where it was first seen in 1901. By July the characteristic glandular hairs had turned to a rusty brown, so that the plant seemed to be infected with a rust. This is what attracted attention to it.

SCHIZAEACEAE.

Lygodium palmatum (Bernh.) Swartz. This is not in the list of Sollers, but he afterwards knew of the chief station, a swamp on the turnpike from Baltimore to Washington. It is not found there any more.

POLYPODIACEAE.

Polypodium polypodioides (L.) Watt. Found in the District but not near Baltimore.

Lorinseria areolata (L.) Presl. A Coastal Plain plant, but there is one small patch in wet woods on the Piedmont about 300 feet above sea-level.

At Glen Burnie, where it is very abundant, there can be found many curious "*obtusilobata*" forms intermediate between the typical fertile and sterile fronds. There is nothing to indicate that they are the result of accident, like the corresponding forms of *Onoclea sensibilis*.

Asplenium Bradleyi D. C. Eaton. Found by J. H. Brummell. Growing on a high rocky cliff and on neighboring rocks on the upper Patapsco River.

Asplenium montanum Willd. On my first visit to the *Bradleyi* station this fern was found growing with it, but in much smaller numbers. These two species are now nearly if not quite extinct at this place.

Asplenium ebenoides R. R. Scott. A single plant was found on an outcrop of limestone near Towson, Balto. Co.

Asplenium pinnatifidum Nutt. This has not been found in the region, but it is not scarce on rocks along

the Susquehanna above Port Deposit. Two or three fronds from there have each a few areolate veins of exactly the same shape as those of *Camptosorus*.

Asplenium ruta-muraria L. This was reported by Aikin, but has not since been found, although there are numerous outcrops of limestone in Baltimore Co.

Dryopteris phegopteris (L.) C. Chr. This was listed by Aikin, but one would not expect to find it so far out of its range. For several years a special look-out was kept for it, and many plants of *D. hexagonoptera* which closely resembled it were found.

Dryopteris Dryopteris (L.) Christ. In 1894 a little colony of this was found in a railroad cut about one mile from Towson. Although not two yards from the rails, they persisted there for years. Not listed by Aikin or Sollers.

Dryopteris simulata Davenport. Enormous patches of this were found in October, 1894, at Glen Burnie, Anne Arundel Co., two months before it was described by Davenport.

Dryopteris Goldiana (Hook.) A. Gray. Perhaps twenty-five plants, in two widely separated localities, have been found. Not listed by Aikin or Sollers.

Dryopteris Clintoniana (D. C. Eaton) Dowell. A very few plants doubtfully referred to this species, have been found. Not listed by Aikin or Sollers.

Dryopteris Boottii (Tuckerman) Underwood. One plant was found near the Gunpowder River, about twelve miles due north of Baltimore. It was in a road-side thicket and could not be found on a later visit. Another plant was found at Glen Burnie years ago. It was a large clump two years ago, owing to the branching of the rhizome. Not listed by Aikin or Sollers.

Dryopteris spinulosa (Muell.) Kuntze. Not listed by Aikin or Sollers, but not uncommon. Vars. *intermedium* and *dilatatum* were listed by Aikin but not by Soll-

ers. The first is not rare, but the second must be a mistake.

Pteretis nodulosa (Michx.) Nieuwland. Two stations on the Gunpowder River, at one of which the first specimens reported south of Pennsylvania were found, are now deeply submerged, owing to the construction of a new dam. There is at least one station on the Patapsco, not far from Alberton, Balto. Co.

Filix bulbifera (L.) Underw. This was listed by Aikin, but has not been seen in recent years. On the limestone outcrops there are no places known to the writer which seem quite suited to this fern.

EQUISETACEAE.

Equisetum arvense L. Quite common in Baltimore Co., especially along railroads, but it has not been seen in Anne Arundel Co., which lies entirely on the Coastal Plain.

Equisetum sylvaticum L. Listed by Aikin and found by Sollers near Ruxton, Baltimore Co. This place could not be found by the writer, but some years ago he found a colony at Bare Hills, a serpentine outcrop in Baltimore Co.

LYCOPODIACEAE.

Lycopodium clavatum L. Listed by Aikin. Found by the writer at Loch Raven, the part of the Gunpowder River dammed up for the Baltimore water supply. The plants were at such a level that they must have been submerged when the new dam was built. It fruited very sparingly.

Lycopodium carolinianum L. Listed by Sollers as having been found just outside of the limits of the area included in his list: that is a square of twenty-five miles on a side, with the City Hall of Baltimore at the center.

Lycopodium adpressum (Chapman) Lloyd & Underwood. Not listed by Aikin or Sollers, but found by the writer at Glen Burnie over twenty years ago.

Lycopodium tristachyum Pursh. This plant was first seen by the writer in Maine and New Hampshire. It was a great surprise to find it near Rockville, Md., not far outside of the Washington area. It has not been seen near Baltimore.

SELAGINELLACEAE.

Selaginella rupestris (L.) Spring. One station at Loch Raven on the Gunpowder River is so far above the new level of the water that it is safe. The region is now a game refuge and any violator of the law would have a long, roundabout, cross-country walk to get to the plants. The species was listed by Aikin.

ISOETACEAE.

As far as the writer knows, no species of Isoetes has been found, although there are many places that seem to be ideal for these plants.

Of the species listed by Maxon, seven have not been found, but there are four, or possibly five (*Botrychium simplex*) in the Baltimore area which do not occur in the District of Columbia. In addition there are two well-marked varieties, *Osmunda cinnamomea glandulosa* and *Botrychium obliquum oneidense*, which are not mentioned by Maxon. The first of these should surely be found, as it is a Coastal Plain plant which has been collected in Mississippi and New Jersey, as well as in the type locality.

It did not seem worth while to include above a number of less marked, and perhaps entirely vegetative forms, which occur: such for instance, as the different forms of the "lady fern," or a depauperate form of *Dennstedtia punctilobula* which B. D. Gilbert, against

my protest, named var. *nana*. The latter is now under water at the Gunpowder.

Gray's Manual credits Maryland with *Botrychium simplex*, probably on account of Egerton's specimens and with *B. neglectum* (*ramosum*), almost certainly because of the plants found by the writer. One other species, *Dryopteris Dryopteris*, seems to be at the limit of its range.

WASHINGTON, D. C.

What the Latin Names Mean—II.

glabella—Lat. little and smooth.

glandulosa—Lat. with little glands, i. e., hairs with round, often sticky heads.

Goldiana—for John Goldie, 1793–1886, a Scotchman who traveled and collected in eastern North America in the early 19th century.

hexagonoptera—Gr. six-angled-wing; referring to the shape of the wings which occur along the midrib between the pinnae in this fern.

ilvensis—Lat. of Ilva, the ancient name of the Island of Elba.

incisum—Lat. cut into deep, sharp teeth.

intermedia—Lat. in between, intermediate.

lanceolatum—Lat. In botanical usage meaning shaped like a lance-head; referring to the shape of the leaf-segments.

lanosa—Lat. woolly; referring to the character of the pubescence.

latiusculum—Lat. rather broad; referring to the shape of the pinnules of the American bracken as contrasted with those of the European.

Lonchitis—Gr. a lance, an ancient name for some plant with lance-shaped parts.

Lunaria—Lat. moon-wort.

marginalis—Lat. on the edge; referring to the position of the sori.

minus—Lat. smaller.

montanum—Lat. of mountains.

neglectum—Lat. slighted; the name given perhaps because the species was not recognized in the chief botanical manuals of that time.

nodulosa—Lat. with little knots or knobs; referring to the fruiting segments.

noveboracensis—Lat. of New York. Eboracum being the Roman name for the city of York in England. Linnaeus' specimens came from Kalm; but though naming them for New York, he speaks of them as from Canada.

obliquum—Lat., in botanical language meaning with unequal sides; referring to the unsymmetrical bases of the pinnae.

obtusa—Lat. blunt; referring to the shape of the segments.

obtusilobata—Lat. with blunt lobes.

orbiculata—Lat. circular; referring to the shape of the segments.

palmatum—Lat. branched like the outspread fingers of a hand; referring to the shape of the sterile pinnae.

palustris—Lat. of marshes.

parvulum—Lat. small.

pedatum—Lat. Literally, footed, i. e., branched somewhat like a bird's foot, in technical use meaning that the divisions are again branched.

Phegopteris—Gr. oak or beech tree, and fern; perhaps so called because associated with beech trees in its woodland haunts.

pinnatifidum—Lat. pinnately cut, not fully pinnate.

platyneuron—Gr. broad-nerved. Linnaeus adopted this name from the old herbalist Ray; its application to the ebony spleenwort is not apparent.

polypodioides—Gr. resembling the polypody.

pseudocaudatum—Gr. and Lat. false caudatum; referring to the resemblance of the plant in question to *Pteridium caudatum*, for which it was formerly often mistaken.

punctilobula—Lat. with small dotted lobes; referring to the appearance of the sori on the lobes of the pinnules.

pusilla—Lat. dwarf.

pycnocarpon—Gr. densely fruited.

ramosum—Lat. branching. Seemingly inappropriate to the little grape-fern which bears this name in Gray's Manual, but possibly used to contrast it with *Botrychium Lunaria*. The older botanists spoke of a compound frond like that of the bracken as "ramose."

regalis—Lat. royal; perhaps referring to the beauty and stateliness of well-developed specimens of this fern.

resiliens—Lat. springing or bending back, elastic.

rhizophyllus—Gr. root and leaf; referring to the well-known "walking" habit of the plant.

rutaefolium—Lat. having leaves like Ruta, the European rue.

Ruta-muraria—Lat. wall-rue; probably a translation of a popular name.

schizophylla—Gr. split-leaved; referring to its forking habit.
scopulina—Lat. of cliffs.
sensibilis—Lat. sensitive; referring to the plant's susceptibility to injury by frost.
serratum—Lat. toothed like a saw; referring to the margins of the leaf.
simplex—Lat. simple.
simulata—Lat. imitated; referring to the resemblance between the Massachusetts fern and certain forms of the lady fern.
spinulosa—Lat. bearing small spines; referring to the spiny teeth.
Stelleri—for Georg Wilhelm Steller, 1709–1746, a German naturalist in the Russian service.
Struthiopteris—Gr. ostrich fern, a name perhaps given from a fancied resemblance of the fronds to feathers.
tenuifolium—Lat. thin-leaved.
ternatum—Lat. in threes; referring to the principal divisions of the frond.
Thelypteris—Gr. female fern—the exact equivalent of the Latin Filix-femina, though used for an entirely different fern.
tomentosa—Lat. covered with short, matted hairs.
Trichomanes—Gr. Said to be an ancient name for some fern.
viride—Lat. green; referring to the color of the midrib in contrast to that of related species.
vulgare—Lat. well-known.

Recent Fern Literature.

The September number of the "*Nature Study Review*" is entitled "The Fern Number" on its cover which bears also a halftone of brake leaves, "a fern whose home is the world." The table of contents lists "Fern Study", "How to know the ferns," and a "List of common ferns" as the leading articles.

"Fern Study" gives in simple language something of the history, structure and reproductive processes of ferns. "How to know the ferns" describes in non-technical terms the fern families and species of our northern states. Both these articles are illustrated by numerous line cuts. The "List of common ferns" in-

cludes seventy-two species. These articles would appear to be admirably designed to serve the purpose for which they were intended, namely, to interest and inform teachers of nature study and elementary science. Beginners in fern study will find them helpful and interesting. The only point that might be commented upon as a lack was the absence of any mention of fern books for further information—such books, for instance, as Clute's "Our ferns in their haunts," Parson's "How to know the Ferns," Slosson's "How Ferns grow", and Waters's "Ferns."

Two separates from Carl Christensen were received in October, both issued in 1920.

"New species of Hymenophyllaceae from Madagascar" was published as Fascicule 12 in Notes Ptéridologiques of Prince Roland Bonaparte. Five new species of Trichomanes are described, together with related species of the African islands.

"A monograph of the genus Dryopteris, Part II; The tropical American bipinnate-decompound species." Mém. de l'Acad. Roy. des Sci. et des Let. de Danemark, Copenhague; Sect. de Sci. Ser. 8; **6:** 1–132; f. 1–29. 9 Je 1920.

Part one of Christensen's Dryopteris monograph, reviewed at the time of its appearance, 1913, dealt with the species of Dryopteris less than twice pinnate. In the present paper, all the remaining tropical American species are described, making a total of 347 species. Mention is made of the fact that 17 other species occur north of the tropics, a grand total of known forms of 364. Mr. Christensen estimates 500 as the probable number of American species with a probable equal number native in the Old World. When one pauses to consider a genus of one thousand species, of which less than a score are common in the United States, the difficulty of reaching well grounded conclusions from a

study of our native forms is obvious, and the importance of such monographic work as the present article is evident.

Eleven subgenera are differentiated, noted as probably good genera, but conservatively treated under Dryopteris pending further study of Old World forms.

R. C. B.

Miss E. F. Andrews has given an interesting account of the resurrection fern (*Polypodium polypodioides*). This little species is the only fern having a wide range in the United States which is habitually an epiphyte. Throughout the southeastern states it is a common inhabitant of the trunks and branches of trees, often occurring, to the astonishment and pleasure of northern visitors, on shade trees in city streets. It is not very particular as to the species on which it grows. It seems, however, never to have been found on any conifer except the red cedar and it generally avoids trees with smooth or freely exfoliating bark which offer it only an insecure foothold.

Miss Andrews tested the effect of the scales with which the lower surface of the fronds is thickly covered, in preventing transpiration by removing all of them from part of the fronds of a given plant. When exposed to drought, the denuded fronds withered more quickly than the others and recovered more slowly when moisture was again supplied. She also tested the fern's capacity for "resurrection" by keeping a mat of it in her house wholly without water, and at intervals detaching portions of it and supplying them with moisture. Six months after the mat had been gathered, specimens fully revived in from 12 to 24 hours after being given water; after 14 months and six days of desiccation, one root still retained enough vitality to expand two fronds,

though, like a starving man given food too late, it did not long survive.[1]

Mrs. Elizabeth Wuist Brown recommends the use of nutrient solutions in growing fern prothallia for class use. She finds these solutions both time and trouble savers as compared with soil, peat and other media. Knop's and Prantl's, especially the latter, are the best. Formulae for various solutions and detailed directions for sowing the spores and caring for the cultures are given.[2]

Dr. Carl Skottsberg, assisted by Mrs. Skottsberg, has, in recent years, made extensive collections in the islands of Juan Fernandez (familiar to most of us as the reputed scene of the adventures of Robinson Crusoe and his man Friday) and in Easter Island. There has now been published under his editorship a work on the natural history of these regions. In the portions dealing with the pteridophytes Mr. Christensen has collaborated with him and this part of the work has been reprinted in pamphlet form.

The treatment is in the form of a copiously annotated list, giving full synonymy, descriptions where needed, localities on the islands, range elsewhere and critical notes. Line drawings by Mr. Christensen further elucidate the less known or more critical species and there are five beautiful photogravure plates of ferns *in situ*.

From the Juan Fernandez group 49 species of true ferns and two Lycopodiums are recorded. Of these four are described as new and nine are recorded from the islands for the first time. As might be expected in an ancient insular flora, the number of endemic species—

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[1] Andrews, E. F. Habits and habitats of the North American resurrection fern. Torreya **20:** 91–96, fig. 1. Sept.–Oct., 1920.

[2] Brown, Elizabeth Dorothy Wuist. The value of nutrient solutions as culture media for fern prothallia. Torreya **20:** 76–83, figs. 1, 2. July-August, 1920.

17—is proportionately large, just one third of the whole, and nearly as many more are known elsewhere only from Chile. Easter Island, smaller and farther out in the Pacific, can boast of but twelve species, five of them here recorded for the first time. Most of them are species of wide distribution in the tropics or at least on the islands and continental shores of the south Pacific, but two (one of them described as new) are endemic and one is known elsewhere only from Tahiti.[3]

American Fern Society

Partly, at least, because of the delay in issuing the last number of the JOURNAL and consequently in getting in the bills for 1920, not all of the officers' reports were ready at the time of going to press. It has been thought best to issue this number without waiting for them, thereby getting the JOURNAL back to schedule time, or near it, and to print all the reports together in the next number.

Susan Hubbell Bancroft (Mrs. Edward H.), of New York City, a member of the American Fern Society since 1916, died on February 11, 1920.

Mrs. Bancroft took up the scientific study of ferns after she was sixty years of age and continued it almost to the time of her death at nearly eighty. Her special love for ferns had been a life-long passion; and while never claiming to be more than an amateur, in these later years she made herself an authority on the ferns of the locality of her summer home, Greensboro, Vermont, and was the inspiring influence that started many others of the summer colony there in similar study.

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[3]Christensen, Carl and Skottsberg, Carl. **The Pteridophytes of the Juan Fernandez Islands. pp. 1–46, figs. 1–7,** pls. 1–5. The Ferns of Easter Island. pp. 47–53, figs. 1–3. Upsala, 1920.

One of the features of Mrs. Bancroft's home, "Ramblewood," is a fern garden in which, enclosed in a stretch of wild woodland, over forty varieties of ferns grow in generous masses in a habitat as nearly as possible like that which they choose for themselves, whether dry or moist, on exposed slopes or in sheltered hollows, on rocks, in moss, or drooping over mossy logs.

Mrs. Bancroft's herbarium of ferns, including specimens from many parts of this and other countries, is on large mounts, 12 ×18 inches, and in addition to the usual scientific features, seeks to retain the beautiful curves and characteristics of the fronds as well as hints of the environment in which they grow—the marsh ferns rising from a fringe of pressed grasses—the fragilis from mosses, etc.

These characteristics of her fern garden and herbarium indicate how, to the collector's zest and the scientist's satisfaction in identification, she added an ardent love and tender reverence for these exquisite children of the wild.

In addition to the four items acknowledged in the last number, Mr. Christensen has presented to the Society copies of two of his other papers: *On a natural classification of the genus Dryopteris* and *Dryopteris species et varietates novae.*

The leaflets inclosed in this number will serve to acquaint members of the American Fern Society with the effort that is being made to increase the membership of the Society. Members are asked to cooperate by sending these to friends who are likely to be interested. If more can be used they may be obtained from any one of the committee,—Robert A. Ware, 246 Devonshire St., Boston, Mass.; Mrs. Carlotta C. Hall, 1615 La Loma Ave., Berkeley, Calif.; E. J. Winslow, Auburndale, Mass.

Change of address:

Dr. Walter Mendelson, 639 Church Lane, Germantown, Philadelphia, Pa.

American Fern Journal

Vol. 11 APRIL–JUNE, 1921 No. 2.

Notes on American Ferns—XVII. [1]

WILLIAM R. MAXON.

WOODSIA SCOPULINA D. C. Eaton. In Rydberg's Flora of the Rocky Mountains (1917), this species is reported from the Great Craggy Mountains, North Carolina. This fact was overlooked by the writer in 1919[2] when reporting *W. scopulina* from the vicinity of Old Sweet, West Virginia, a supposed new record for the eastern United States. The basis of the North Carolina record is material in the herbarium of the New York Botanical Garden collected "in the sun, upon a cliff of the Great Craggy Mountains, Buncombe County, North Carolina, at an elevation of about 5,000 feet," and sent by James H. Ferriss to Prof. L. M. Underwood in September, 1901. This material, as shown by a portion deposited in the National Herbarium, is quite typical. Aside from these two outlying southern stations the known range of this species is as follows: Alaska (two localities) to Quebec (Gaspé County), Ontario, South Dakota, Colorado, and Utah (ascending to 3,300 meters), and in the Sierra Nevada sparingly to Tulare County, California.

EQUISETUM VARIEGATUM Schleich. In their recent Flora of the Northwest Coast, 1915, Piper and Beattie in referring to the occurrence of *E. variegatum* in Washington suggest the probability of its occurrence farther

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[1] Published by permission of the Secretary of the Smithsonian Institution.

[2] Amer. Fern Journ. **9**: 2. 1919.

[Vol. 11, No. 1 of the Journal, pages 1--32, was issued March, 1921]

south. The prediction is borne out by a single specimen, hitherto undetermined, in the National Herbarium. This was collected on the sandy bank of the Minam River, Oregon, at a point near its mouth, altitude 850 meters, August 13, 1897, by E. P. Sheldon (no. 8689, in part). It belongs to that form of the species described by A. A. Eaton as var. *alaskanum*.

LYCOPODIUM OBSCURUM L. This species was recently reported by Piper and Beattie[3] from a single locality in Washington, 23 miles northeast of the small town of Snoqualmie, upon material collected by L. A. Nelson in 1909. The record is substantiated by a specimen in the National Herbarium. Mr. Nelson's notes indicate that only the single small station in central Washington is known, this having been discovered by him in 1907. The plants are said to grow under small fir, cedar, and hemlocks, at about 2,800 feet altitude.

SELAGINELLA RIDDELLII Van Eseltine. Following the original description of this species the range is given as "Central and eastern Texas, probably through southern Louisiana." Numerous specimens are cited from Texas, but none from Louisiana. There is, however, a reference to Riddell's manuscript description in the Gray Herbarium. Riddell's descriptive notes, which have recently been examined by the writer, give definite distributional data which it seems worth while to put on record. They conclude with the following statement: "On dry sandy hills near Kisatchy Springs, Western La., *Hale*. Also on dry granular quartz rocks, at Kaolin Creek, near the San Saba, Texas, where I first found it in November, 1839. The foregoing description is drawn from the Texas specimens, as my sample from Dr. Hale, though doubtless the same, is not

[3] Fl. Northw. Coast 14. 1915.

in fruit." There are two different collections of this species by Hale in the Gray Herbarium; one is marked merely "Louisiana, *Hale*"; the other is labelled "Sandy hills, Red River, Louisiana. *J. Hale.*" Both are fertile, the latter conspicuously so.

SELAGINELLA NEOMEXICANA Maxon. This species when described[4] was known to the writer only upon specimens collected several times in the Organ Mountains, New Mexico, by E. O. Wooton. The range is considerably extended by a specimen in the Gray Herbarium, collected at Paradise, Cochise County, Arizona, March, 1904, by James H. Ferriss. This, like the New Mexican specimens, appears to bear no mature megaspores.

SELAGINELLA OREGANA D. C. Eaton. Underwood, in his initial work on the group of *Selaginella rupestris* in 1898, took up for the Pacific coast plant generally known as *S. oregana* D. C. Eaton the name *S. struthioloides*, remarking upon previous failures to associate the description of *Lycopodium struthioloides* Presl (from Nootka Sound) with *Selaginella oregana*. A recent study of Presl's description, however, indicates rather clearly that Presl was here describing a true *Lycopodium* and that those writers who have referred the name to forms included in the tropical American complex of *Lycopodium taxifolium* Swartz are probably correct, the locality "Nootka Sund" being erroneous and presumably due to crossed labels.

It may be admitted that the name "*struthioloides*" is peculiarly appropriate to our west coast *Selaginella*, in which the numerous slender branches are recurved, like ostrich plumes, in loosely intricate clusters. On the other hand, Presl, however radical his ideas as to multiplying genera, habitually described his plants with

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[4] Smiths. Misc. Coll. **72**[5]; 2. *pl. 1.* 1920.

great exactness; and beyond the name itself there is nothing in his description to indicate distinctively the plant since called *Selaginella oregana*. He describes the leaves as 3 lines (6 mm.) long and ⅔ of a line (1.3 mm.) broad, and as glaucous-green. In *S. oregana* the leaves are 2.35 to 3.35 mm. long and never exceed 0.62 mm. in width, the dimensions being thus about half those given for *Lycopodium struthioloides;* they are besides of a peculiarly bright green color, without any trace of glaucous covering. Moreover, Presl placed *L. struthioloides* among the true Lycopodiums and compared it with *L. passerinoides* (a form of *L. taxifolium*), which in itself is almost sufficient evidence that he was not dealing with a *Selaginella*.

Under the circumstances, and at least until Presl's type can be examined, it seems best to restore Eaton's name. The type of *S. oregana* is from Port Orford, Oregon. The synonymy is given below.[5] The range of this species embraces the humid coastal belt from western Washington (Chehalis and Thurston counties) southward to Humboldt County, California. The plants are notably lax and, though occasionally found on the moist litter of forested banks, usually hang from the mossy trunks and branches of forest trees, attaining a length of 60 or even 90 cm. The leaves differ from those of most other United States species of *Selaginella* in being long-decurrent (up to 1 mm.).

Selaginella scopulorum Maxon, sp. nov. Stems prostrate, short-creeping, 3–6 cm. long, pinnately branched, subcespitose, forming large mats; branches numerous, close, the sterile ones mostly 0.5–1.5 cm. long, ascending, simple or with several very short, oblique divisions. Leaves appressed-imbricate (those on the under side largest), chartaceous, subglaucous, linear to lance-subulate, narrowed to an obtusish apex, 2.35–3.25 mm.

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[5] SELAGINELLA OREGANA D. C. Eaton in S. Wats. Bot. Calif. **2:** 350. 1880. *Selaginella struthioloides* Underw. Bull. Torrey Club **25:** 132. 1898. Not *Lycopodium struthioloides* Presl. Rel. Haenk. **1:** 82. 1830.

long (seta included), 0.3 0.6 mm. broad; seta 0.3 0.6 mm. long, stiff, scabrous, whitish-hyaline from a long lutescent base; cilia 4–8 (11) on each side, 0.06 0.12 mm. long, mostly oblique and incurved. Spikes numerous, 1–2.5 cm. long, slender, suberect; sporophylls coriaceous, deeply concave, broadly ovate, long-acuminate, mostly 2.2–2.8 mm. long (seta included), 1–1.3 mm. broad; seta 0.3–0.55 mm. long, subentire, pungent, whitish-hyaline from a long lutescent base; cilia usually 8–15 on each side, stout, 0.04–0.06 mm. long, the upper ones dentiform; megaspores subglobose, yellow, about 0.4 mm. thick, foveolate-reticulate; microspores orange, about 0.047 mm. thick.

Type in the U. S. National Herbarium, no. 1,028,641, collected in the vicinity of Cracker Lake, Glacier National Park, Montana, altitude 1,740 to 1,920 meters, on moss-covered rocks, July 15, 1919, by Paul C. Standley (no. 15732). Other material referred to this species is as follows:

MONTANA: Numerous localities in Glacier National Park, at 1,350 to 2,600 meters elevation, on exposed rocks, rocky banks, and talus slopes, and in dry or moist meadows, *Standley* 15318a, 15598, 16216, 16255, 16288, 16378, 17055, 17164a, 17979, 18050, 18185; *Ulke*; *Umbach* 856.

WASHINGTON: Mica Peak, Spokane County, *Suksdorf* 8834. Mount Olympus, *Flett* 3092.

OREGON: Sumpter Valley watershed, Blue Mountains, alt. 2,280 meters, *Ferris & Duthie* 941.

WYOMING: Upper Falls of the Yellowstone, *Mearns* 4274. Mouth of Buffalo River, *Merrill & Wilcox* 1218. Middle Ten Sleep Creek, Big Horn County, *Goodding* 483.

BRITISH COLUMBIA: Carbonate, alt. 810 meters, *Heacock* 235. Mount Copperstain, alt. 2,400 meters, *Shaw* 398. Above Revelstoke, alt. 1,290 meters, *Shaw* 902. Goldstream, alt. 660 meters, *Shaw* 1060.

Of the British Columbia and Wyoming material above cited duplicates of *Goodding* 483, *Merrill & Wilcox* 1218, *Shaw* 902, and *Shaw* 1060 were determined as *S. densa* Rydb. by Hieronymus, while *Shaw* 398 and *Heacock* 235 were called by him *S. columbiana* A. A. Eaton, this

apparently an unpublished species name.[6] *Selaginella densa* (of which *S. Haydeni* Hieron. and *S. Bourgeauii* Hieron. are undoubted synonyms) is clearly the nearest ally of *S. scopulorum* and agrees with it closely in habit. But *S. densa*, at least as found in the northern region of the Dakotas, Montana, and Wyoming, is a plant readily recognized by the conspicuous tufts of very long, slender, white, subpilose-serrulate bristles at the ends of the branches. In *S. scopulorum* the terminal awns are not only shorter, stiffer, and more nearly straight, but are whitish-hyaline from a plainly *lutescent* base, and they are never aggregated in tufts, as in *S. densa*. The blades of the foliage leaves are different in the two species also; those of *S. densa* are obtuse and terminate abruptly in a long filiform bristle, while those of *S. scopulorum* are less obtuse, tapering slightly to the awn proper through a thick, distinctly lutescent awn-base. The sporophylls of *S. densa*, moreover, are conspicuously long-ciliate, with oblique hairs; in *S. scopulorum* the sporophyll cilia are very much shorter and less oblique.

In the territory from Wyoming southward to New Mexico there occurs a puzzling series of plants, usually referred to *S. densa*, which need the most critical study. A part of this material is probably referable to *S. Engelmanni* Hieron.,[7] which may have to be taken up as a subspecies of *S. densa*. With the accumulation of more ample material the writer hopes to be able to discuss *S. densa* and related forms in a later paper, including their relationship to typical *S. rupestris*.

Selaginella scopulorum is the plant listed by Standley,[8] upon the writer's identification, as *A. montanensis*

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[6] Not to be confused with *S. rupestris columbiana* Jones (Bull. Univ. Montana, Biolog. Ser., **15:** 8. 1906), described from Idaho. This, so far as the few words of description indicate, is referable to the intensely variable and polymorphic *S. Wallacei* Hieron.

[7] The type of *S. Engelmanni* has not been seen by the writer.

[8] Flora of Glacier National Park (Contr. U. S. Nat. Herb. **22:** 235–438. *pls. 33–52.* 1921).

Hieron.; but a recent examination of a part of Hieronymus' type shows *S. montanensis* to be hardly distinct from *S. Wallacei*, as now understood. That collective species is well set apart from *S. densa* and allied species by its laxly cespitose or short trailing stems, its elongate ascending, branched, cordlike branches, and its uniform, rigidly ascending leaves, these never unequal and secund. Habital characters in this group were not well brought out by Hieronymus, who had, unfortunately, only very scant material at his disposal.

WASHINGTON, D. C.

A New Western Species of Pellaea.

F. K. BUTTERS.

In 1917, I published in the Fern Journal[1] some observations on *Pellaea atropurpurea*, *P. glabella*, and certain western forms related to the latter species. In that paper, I treated these western forms as varieties of *P. glabella*. After its publication Mr. W. R. Maxon called my attention to certain specimens of western *Pellaeas* in the National Herbarium, and very kindly sent me all the material of *P. glabella* and its varieties in that herbarium. The results of the study of this material, together with a considerable amount in the herbarium of the University of Minnesota were embodied in an article, which was prepared for publication last summer. An unfortunate loss of manuscript has necessitated the rewriting of this article, and as it will be several months at least before it can be published, it seems best to publish in a preliminary note the conclusions reached.

[1] Am. Fern Journ. **7**: 77. 1917.

Both of the western forms described in my former article as varieties of *Pellaea glabella* appear to be distinct species. One of these, *P. pumila* Rydb.,[2] has already been described as a species. The other, my *P. glabella* var. *simplex*, I have determined to name *P. Suksdorfiana*,[3] as the most complete specimens which I have seen are the collections of W. N. Suksdorf (Flora of Washington, no. 2083) from cliffs near the Columbia River in Klickitat Co., Wash. My original description was drawn from somewhat depauperate material, and the diagnosis there published will have to be modified to include fronds up to 16 cm. long, and to admit the occasional compounding of the lower pinnae.

P. glabella and the two western segregates all differ consistently in the shape and texture of the pinnae, certain details of the indusium, the texture and microscopic structure of the stipe, and the size of the spores. The two western species may be distinguished readily by the last-mentioned character, for the average length of the spores in any mount from material of *P. Suksdorfiana* is 65μ or more, while the average length of the spores in *P. pumila* is less than 55μ. This distinction in size applies to both elliptical and tetrahedral spores, both of which have now been observed in each species.

UNIVERSITY OF MINNESOTA.

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[2] Mem. N. Y. Bot. Garden, **1**: 4. 1900. Rydberg's alternative name, *P. occidentalis*, published in the appendix to the same work (loc. cit. p. 466) is untenable, as it is confessedly a mere renaming of the same plant. It is based on Elias [not Aven] Nelson's varietal name *P. atropurpurea occidentalis*.

[3] PELLAEA **Suksdorfiana** n. sp., *Pellaea glabella* Mett. ex Kuhn, var *simplex* **Butters, Am. Fern Journal 7: 84. 1917.**

Nephrolepis nutrition.

R. C. BENEDICT.

The photograph accompanying this article illustrates in an interesting way the roundabout method employed by Nephrolepis species in getting their food supply. Two plants of a fish tail variety of Boston fern, *N. bostoniensis Gretnai*, are shown, both the same age and in the same size three inch pots. Both were grown close

to each other at the Brooklyn Botanic Garden and had the same amount of light and warmth.

Note, however, the remarkable difference in size and general vigor. The plant shown at the right has produced seven or eight fair sized leaves and a few of the slender rhizomes or stolons by which Nephrolepis spreads and propagates itself vegetatively. On the other hand, the plant at the left and above has between thirty and forty much larger leaves and a large number of vigorous branching stolons.

In connection with these stolons is a large mass of roots with a few leaves showing. Herein lies the difference in the size and growth of the two original plants. Both started out the same size, but the one on the left happened to send out one or more stolons so that these projected into a tank of water underneath. These straightway gave rise to roots and through them an increased amount of water and dissolved mineral matter was sent up and back to the parent plant in the pot. More food meant more leaves, and with each new leaf, a new stolon sent out to find the rich source of food below.

The progression is geometric at least. The other plant whose root development was confined to the limits of the three inch pot could receive only the amount of water obtainable from the small quantity of soil in the pot. It would not do to stand such a pot in water, for then the roots would not obtain sufficient air, the soil would become heavy and ferment with the organic matter in it, and the plant would die rather quickly. But with the other plant, the pot and soil give it its mechanical support, the numerous stolons together with the leaves serve as breathing organs, and the mass of roots formed in the water absorb as much food as the leaves are able to utilize. An interesting fact in connection with the root system of Nephrolepis may be

noted here The main stem axis does not produce roots. These are all developed as outgrowths of the stolons, one of which is given off in connection with each leaf on the main axis. These stolons spread laterally and tend to penetrate the soil. In moist conditions, they give off fibrous roots, and, through these, obtain for the plant necessary water and dissolved mineral matter. In addition, they may also develop buds and new stem axes, and so give rise to new plants. In fact, this is the regular method of reproduction.

To those of us who like to keep a plant of the Boston fern as a house pet,—and it is the commonest house plant in the country,—there is a practical application. Ordinarily, it is necessary to repot Boston ferns rather frequently, preferably in the spring, In a vigorously growing plant, each repotting means a larger pot, and the limit of house culture is reached rather soon. If, however, a source of water can be supplied without standing the pot in the water, it should be possible to maintain a Boston fern plant more or less indefinitely in a smaller pot, by allowing the stolons to reach into a constant supply of water. The simplest method of arranging for this is perhaps to support the pot some inches above the bottom of a fairly deep jardiniere, and to keep the bottom of the jardiniere filled with water. This will not entirely do away with the need of repotting, as the leaf bearing axis tends to grow continually upward and out of the soil, so that occasionally, it would be necessary to reset this main axis into a new pot of the same size as before. At any rate this should obviate the necessity of the very frequent watering ferns often require in the dry air of our steam-heated houses.

BROOKLYN BOTANIC GARDEN.

An Overlooked Species of Dryopteris.

CARL CHRISTENSEN.

During the elaboration of the second part of the Monograph of the genus *Dryopteris*, published in 1920, my attention was often drawn to the Cuban species described in 1902 as *Polypodium cryptum* Underw, & Maxon, which, from the figure and the characters ascribed to it, appeared to be a species of *Dryopteris* of the subgenus *Goniopteris*. Unfortunately my work was greatly interrupted by the war, and in the final revision of the manuscript I totally forgot this species. Mr. William R. Maxon had, however, come to the same conclusion as to its relationship and he on his own initiative, sent me very recently a portion of the type of *P. cryptum* together with parts of other specimens collected by Shafer in 1910. An examination of these plants shows at once that the species must be referred to the subgenus *Goniopteris*. It may therefore be called:

Dryopteris crypta (Underw. & Maxon) C. Chr. & Maxon, comb. nov.

Polypodium cryptum Underw. & Maxon, Bull. Torrey Club, **29**: 579. *fig.* 1902.

Cuba (Prov. Oriente): Vicinity of Baracoa, Feb. 1–7, 1902, *Pollard, Palmer & Palmer* 231 (type, U. S. Nat. Herb. no. 403232). Rio Guayabo, "above the falls," alt. 450–550 meters, in damp shaded places among large rocks January, 1901, *Shafer* 3720. Camp La Gloria, south of Sierra Moa, December 24–30, 1910, *Shafer* 8173. Rio Yamaniguey to Camp Toa, alt. 400 meters, on clay bank, Feb. 22–26, 1910, *Shafer* 4000.

The original description and drawing give a good idea of this small species. It falls under the section *Asterochlaena* of the subgenus *Goniopteris*, but it is apparently quite distinct from all other species of that group, and

it is rather remarkable that although I have had large collections of Cuban ferns for study, I have not met with it before. I have little doubt that these small plants belong to a distinct species. Nevertheless, juvenile fruiting plants of a good many species of ferns look often very different from full-grown individuals, and it is sometimes a matter of doubt whether such small individuals are young plants of species that with age grow much larger or, on the other hand, represent really good, distinct species. In the present case it is possible that *D. crypta* is a small form of *D. guadalupensis* (Wikstr.) C. Chr. (Mon. I, p. 213). Smaller forms of this species come very near to *D. crypta* in several characters, especially in general habit and in cutting of the lamina, but there are some differences which make it advisable not to unite *D. crypta* with *D. guadalupensis*. In the former the stipe and midrib are, as in *D. guadalupensis*, stellate-pubescent but are, besides, furnished with longer simple deciduous hairs, which are not met with in most forms of *D. guadalupensis*; in the variety *setulosa* C. Chr. (Mon. II, p. 25), from Haiti, these are, however to be found. The margins of *D. crypta* are ciliate and the surfaces glabrous; in *D. guadalupensis* the margins are not ciliate, and the surfaces are stellate-pubescent along the veins. In *D. crypta* the veins are nearly always free, being simple or forked; very rarely two veins are united. In *D. guadalupensis* the lower veins always form a costular areole, even in small leaves which in size and cutting are similar to leaves of *D. crypta*. The sori of *D. crypta* are slightly immersed in the thick substance of blade and are quite exindusiate; the sporangia are glabrous. In most specimens of *D. guadalupensis* a stellate-pubescent indusium is found.

From these differences it seems fully justifiable to regard *D. crypta* as a valid species. The four collections

examined are rather uniform; the leaves are either crenate-pinnatifid throughout or are furnished with one or two distant, nearly circular, free pinnae below.

BOTANISKE MUSEUM, COPENHAGEN.

A New Polypodium from Vermont.

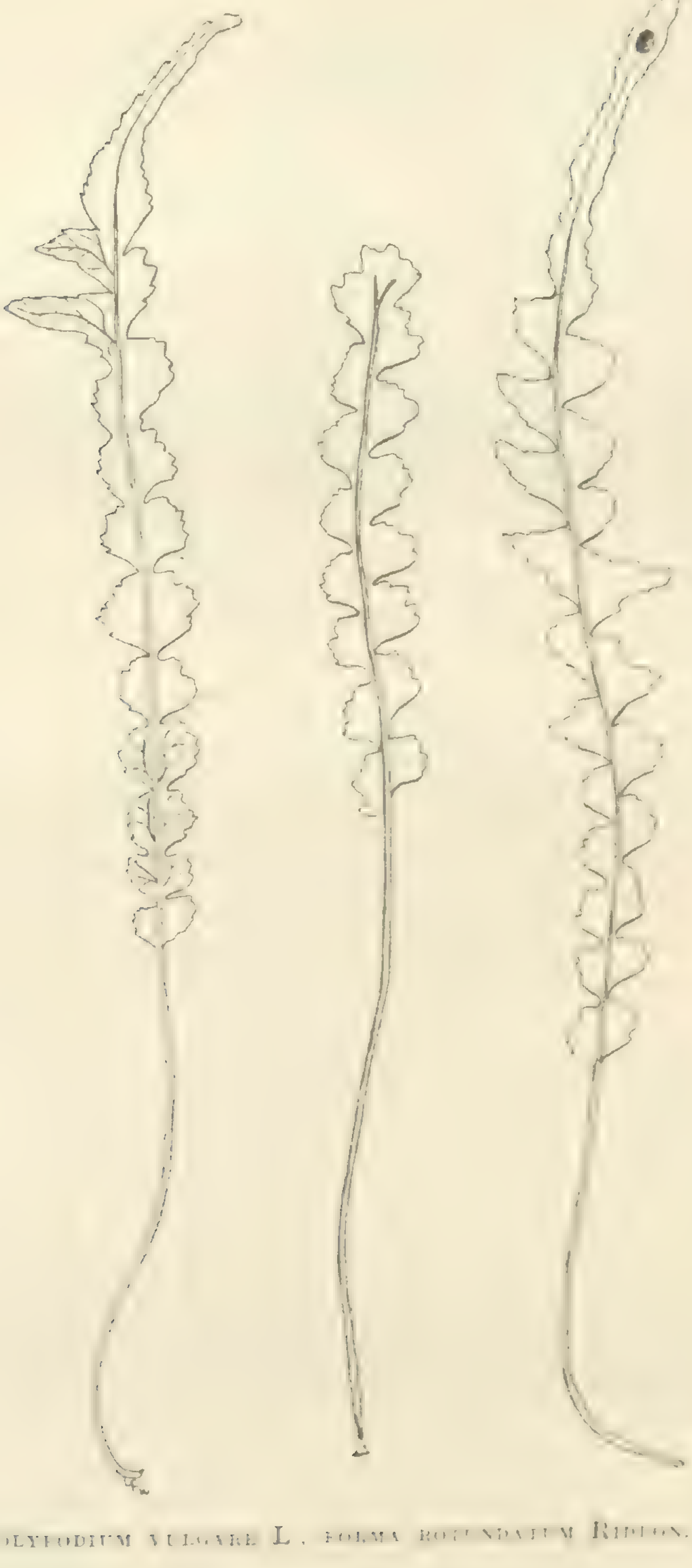
H. C. RIDLON.

In the late autumn of 1919, an acquaintance of mine, while gathering material to fill berry-bowls, collected, among other things, some small polypodiums which were growing in their usual habitat upon a bowlder.

Some few weeks later my attention was called to two of these ferns which differed very much from the others in their short, rounded pinnae, but which were unmistakably polypodiums. Through the kindness of the collector, these two plants were given to me, and were transferred to a glass bowl where they were carefully watched to see what forms any new developing fronds might assume. Both plants survived the first winter and each produced several new fronds which were of unusual form but in which the pinnae and tips of the blades were more elongated. One plant died in July of this past year and the other, still alive, has been transferred from the covered bowl to an open receptacle, in hopes it may produce fronds more like those it possessed when first discovered.

All available articles on the American forms of *Polypodium vulgare* have been carefully looked over, also Druery's excellent book on "British Ferns and their Varieties," but I find no form described which approaches this one.

In one plant the fronds were lacking tips except for a short projection of the rachis. In the other specimen the fronds terminated in an elongated tip, otherwise the



Polypodium vulgare L., folma rotundatum Ripley.

fronds of the two were alike. The fronds averaged 12 to 15 centimeters in length and one centimeter in width. The stipes were about six centimeters long, slender and channeled. The average width of frond was one centimeter. The pinnae were nearly semi-circular or broadly semi-elliptic in outline, 5–7 millimeters in width, 3–5 in length, coriaceous, dark green in color and bluntly and somewhat irregularly toothed; the shorter with a mid-vein which arose near the lower edge of the pinna, ascended nearly parallel to the rachis and gave off about four simple or forked veinlets on the outer side only; the more elongate pinnae with a more or less well-developed mid-vein with branches on both sides, as in typical plants of *P. vulgare*.

Since it is often desirable to have names for such peculiar forms, this one may be called *Polypodium vulgare*, forma **rotundatum** n. f.[1]

BENNINGTON, VT.

Salvinia in Minnesota.

F. K. BUTTERS.

For some years the various floras of the eastern United States have reported *Salvinia natans* (L.) All. as occurring in the vicinity of Minneapolis. These reports seem to be based on material distributed by the Herbarium of the University of Minnesota about thirty years ago. In 1916, after a careful investigation of the origin of this material, Professor Rosendahl and I published the following statement:

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[1] An analogous variation is found in the plant known as *Nephrolepis Duffii* Moore. This is a form of *N. cordifolia* in which the usually oblong pinnae are reduced to short, semi-circular affairs, exactly as in Mr. Ridlon's plant. Like it, too, *N. Duffii* is not a form developed under cultivation, but was first found in the wild.—C. A. W.

"The reports of the occurrence of this species in Minnesota are based on its spontaneous appearance at the University Greenhouse in a tub of water in which had been placed a quantity of aquatic plants, muck, etc., collected in Sweeney Twin Lakes in the vicinity of Minneapolis. From this origin it has flourished in the greenhouses of the University for more than thirty years. It has never been found growing in the open in Minnesota, though a careful search has been made in the Sweeney Twin Lakes and elsewhere. At the time when it appeared a number of aquatic plants from outside of the state were being handled in the greenhouse, and we are constrained to think that this plant was introduced along with some of them."[1]

Shortly after the appearance of this publication, Dr. H. L. Lyon of Honolulu, who formerly had worked extensively with the pteridophytic collections of this herbarium, suggested to me that apparently the plant in question is not *S. natans* at all I had allowed the question to rest until last summer, when I received a letter from Mr. C. A. Weatherby, stating that an examination of the Minnesota material in the Gray Herbarium indicated that it is *S. auriculata* Aubl., and suggesting that I examine all available Minnesota material, and send a note to the Fern Journal embodying my conclusions.

An examination of both living plants and herbarium material has convinced me that it is all *S. auriculata* var. *Olfersiana* Klotzsch ex Baker. *S. auriculata* may be easily distinguished from *S. natans* by its nearly orbicular leaves, which are covered on the upper surface with clusters of trichomes raised on tall whitish papillae, which in the middle of the leaf are 2 mm. or more long, and by the numerous pinnate veins, which in

[1] C. O. Rosendahl and F. K. Butters, Reputed Minnesota Plants which 4robably do not occur in the State. Minnesota Botanical Studies, 4: d65. 1916.

dried material may be seen on the upper side of the leaf. In *S. natans* the leaves are elliptical, the trichomes borne on low papillae, and the veins imbedded in the tissues of the leaf and very obscure. The variety *Olfersiana* differs from typical *S. auriculata* in having smaller and much thinner leaves (in dried material,—they are rather thick and fleshy in the living plant) with only 15–30 lateral veins on each side, and in the much greater hairiness of all the submerged parts, including the sporocarps. It is possibly a distinct species, and is so treated by Britton in the Flora of Bermuda where there is an excellent figure which might easily have been drawn from the plant now growing at the University of Minnesota.

Both *S. auriculata* and the variety are natives of tropical America, and there is no evidence that either of them will survive a northern winter in the open. Thus it becomes even more improbable that the supposed Minnesota plant is really a native of this state, or has ever lived there outside of greenhouses, except possibly as a brief-lived escape during the summer.

UNIVERSITY OF MINNESOTA.

OTHER RECORDS OF SALVINIA NATANS IN THE UNITED STATES.—Besides Minnesota, three other localities for *Salvinia natans* are given in current manuals. Some account of them may be of interest as a supplement to Professor Butters's note.

The earliest report of the species is in Pursh's Flora of North America, where it is said to have been found "floating like *Lemna* on the surface of stagnant waters in several of the small lakes in the western part of New York." No subsequent botanist has been able to find the plant in this region: we must conclude either that it did not become permanently established, or that it

is one of several very dubious records which Pursh, by no means the most accurate of botanists, admitted into his flora and which are now generally believed to be without foundation of fact.

A second New York locality is on Staten Island. In regard to this, Mr. William T. Davis of New Brighton, in response to a request for information, very kindly writes as follows:

"The so-called *Salvinia natans* . . . . . was first reported by Mr. Thomas Craig from a pond near the Moravian cemetery where he and I collected specimens, and where it was evidently planted along with a number of other aquatic plants. Mr. Craig also found it in Silver Lake, which has since become a reservoir. Under the heading '*Salvinia natans* on Staten Island,' Mr. Craig gave an account of his discovery of the plant in the Proceedings of the Natural Science Association of Staten Island for October 14, 1893 . . . . . At a later date I find that I made the following notes in my journal: 'Sunday, April 3, 1899. I planted *Salvinia natans* in Ketchem's Mill Pond, as I did last spring. I have not been able to find that any planted last year lived over winter.' 'September 23, 1899 (Saturday). In the spring I planted some *Salvinia natans* in Ketchum's Mill Pond and now there are countless numbers of fine plants.'

"This *Salvinia* did not survive the winter, and the specimens reported by Mr. Craig were doubtless, like mine, planted shortly before he collected them."

It is not surprising that the Staten Island Salvinia, though growing vigorously for a short time, could not be made to live through a winter, for specimens of it, which I have had the privilege of examining at the New York Botanical Garden and at the Gray Herbarium, prove to be, like the Minnesota material, *S. auriculata*, var. *Olfersiana*.

The fourth locality given in the manuals is in Missouri. Of this, Rev. C. H. Demetrio, the original and only collector of the plant there, has obligingly furnished the following account:

"Like many other things, *Salvinia natans* was found accidentally. After a botanical excursion in the bluffs of the Bois-brulé Bottoms of Perry Co., Mo., we—my friends and I—were on the homeward way, passing Dixon's Lake. I left the wagon to gather some *Azolla caroliniana*. I took a stick and fished out a bulk of nearly everything. I put the bulk in my botanical tin case because I had no time to clean up everything. The next day I found, besides the Azolla, tangled in decaying leaves of Potamogeton and other stuff, some plants with sporocarps in the form of little balls. I sent a sample to the world-known Nestor of Botany, Prof. Dr. Asa Gray. He pronounced it *Salvinia natans* . .

A month after the discovery of Salvinia I got a call from Emma, Mo., where I arrived December 9, 1886. Since that time I have never seen Dixon's Lake again. I am therefore not able to state whether the Salvinia is growing there, indigenous or spontaneous. The land is low, somewhat swampy and subjected to overflow by the water of the Mississippi River . . . ."

Mr. Demetrio's specimen, sent to Dr. Gray, is preserved at Cambridge and is true *Salvinia natans*. Mr. B. F. Bush and Mr. E. J. Palmer, who have collected very extensively in Missouri in recent years, state that they have never met with the plant.

The claim of *Salvinia natans* to a place in our flora rests, then, on one ancient and very doubtful report, two mis-identifications, and a single authentic collection, never repeated, at a station which has not been re-discovered in 35 years. It surely should not, at present be included in our manuals. There seems, however, to be no reason why true *S. natans* might not become naturalized with us (as its relative, *Azolla*

caroliniana, has become at some places in Europe); for it is not, like *S. auriculata*, a tropical species, but one of wide distribution in northern Eurasia where it must needs endure winters as severe as ours.—C. A. W.

IS BOTRYCHIUM DISSECTUM A STERILE MUTANT OF B. OBLIQUUM?—The question in the title, "Is *Botrychium dissectum* a sterile mutant of *B. obliquum*," is based on a recent article by C. J. Chamberlain in the Botanical Gazette (**70**: 387) under the title, "Grouping and mutation in *Botrychium*." The question is raised in the present instance, not with the idea of casting doubt on Prof. Chamberlain's conclusions, but because the problem is one to which readers of the FERN JOURNAL should be able to contribute additional information. Will you not look over the following summary of the Chamberlain article for the purpose of comparing its data with your own collecting experience or of making it the basis of special study in the coming season? We shall then be glad to hear reports from as many people and places as possible.

Botrychium is reported as almost invariably growing in groups of individuals, not as isolated plants. By "groups" in this case the writer does not mean necessarily that the plants will be clumped together, but that in a patch of thicket where one plant is found, others are almost certain to exist. Several such woods groups are shown plotted on cross-section paper, in Prof. Chamberlain's article, with the location of each individual plant marked, and with different marks for different species of Botrychium.

Of particular importance to the present topic is another observation, that *B. dissectum* never occurs except in association with *B. obliquum*, and then always in smaller numbers. In four plots, mainly in different

localities in Ohio, out of five hundred and one plants of these two species observed and plotted, nineteen only were *B. dissectum*, a ratio of about twenty-five to one. Has any reader ever found *dissectum* growing in groups by itself, or in greater numbers than *obliquum* when in the same group? It will not do to walk through a wood and report one *dissectum* seen and no *obliquum*. Only by painstaking search, yard by yard, if necessary, can the matter of occurrence and distribution be really settled.

The sporangia of *dissectum* are reported as smaller than those of *obliquum*, with numerous aborted sporangia in addition. Microscopic study showed that even the apparently normal ones were often without any spores inside, or with small abnormal looking spores. If *dissectum* is really sterile, or nearly so this would account for its relative infrequency in comparison with *obliquum*. But if it is sterile what is the source of the plants which do occur?

Its origin as a rather frequent mutant is postulated, not only on its apparent sterility, but also on its reported constant association with *obliquum*, and of course, on its very noticeable close resemblance to that form. The only distinctive characters noted are its smaller less fertile sporangia, a somewhat smaller size, and its fimbriated "dissected" margins. Just what this dissection represents is debatable. It is certain that very similar if not identical types of variation may occur in unrelated fern genera. *Dissectum* may represent a type of variation like the lacerate or irregularly lobed margins of such ferns as *Cyrtomium Rochfordianum*, a form of the common florists' holly fern; shown also in several of the *Nephrolepis* varieties, in *Polypodium Mayi*, another florists' variety. Such increases in marginal serration are generally accompanied by a decrease in fertility, and even by an entire failure to

produce sori. *Polypodium Mandianum* (*aureum* var.) has highly ruffled and laciniate pinnae, and only occasionally, rarely, produces sori.

What are your observations as to the occurrence of *B. dissectum*?—R. C. B.

American Fern Society.

Report of the President for 1920.

The most important event in the history of the Fern Society during the past year was the increase in individual membership dues by one-half, a measure adopted by a nearly unanimous vote. There has since been no falling off in membership; the number of members has, on the contrary, increased to 271, a new mark for the Society. This response has been most satisfactory, and the healthy condition of the Society's finances is admirably summarized in the report of the Treasurer, a short statement which each member of the Society is urged to read carefully.

To a very great extent the usefulness of the Society is directly proportional to the size of its membership, for this determines not only the opportunities for correspondence and for exchange of specimens among those most interested in fern study, but largely sets the limit also to the circulation of the JOURNAL, which is our principal evidence of activity. With more members more pages could be published in each number, more money could be allowed for illustrations, and larger editions could be distributed. And with an increase in circulation, assuming that present editorial excellence is maintained, the influence of the JOURNAL would be increasingly great. Thus, particular attention is being given just now to enlarging the membership, the matter being in the hands of a special committee consisting of Robert A. Ware, Chairman, E. J. Winslow, and Mrs.

Carlotta C. Hall. Circulars containing a brief outline of the history of the Society, its needs, its purposes, and its various activities have recently been distributed to the members. It is urged that all do their part by securing one or more new members each, by bringing the Society and its JOURNAL to the attention of local nature study clubs, and by urging subscriptions from colleges and from public libraries even in smaller towns. We could double our membership if we would; and it seems well worth while to make the effort, if we are interested in fern study in anything more than a passive way.

The whole matter as to the success of the Society or the failure to attain its highest aims is determined chiefly by personal interest on the part of the members. Members as a whole care little for descriptions of new species. The growing plants are what really interest them,—relationship, the kind and degree of fertility, the main types of variation, the soil and habitat preferences, the local distribution and companion plants of a given species, and the like; but these fields are not well covered. Much scattered information can be found, no doubt, upon the sequence of the development of the ferns in spring, but we do not know whether the order of appearance noted in a single locality is true for a wide region. Would it not be worth while for 25 members to publish sequence lists for their respective localities, noting departures from year to year? Which fern of the eastern United States *is* the earliest in starting? Do most of the species which start first bring their spores to maturity first? Have we, as a matter of fact, followed most of our species through the season? There is not a fern of the United States, which, if the data can be got together from an intensely interested membership, is worth less than a full number of the JOURNAL, in spite of all that has been written of it in

the past; and this is putting the case very mildly indeed.

Symposia are frequently tiresome; nevertheless, the suggestion which has heretofore been advanced of taking up for study some common fern, or genus of ferns as represented in the United States, is not without merit. Our knowledge of the various species of our own locality is very uneven, far more so than can properly be charged to lack of opportunity for observation. Do we note individual characters only when they are outstanding? Are we too eternally interested in adding a new record to our list to study critically the ferns as we pass them by—"identified?" Are not the intimate details of the Christmas fern less known to us than those of the rarer species? Why do we fail to be truly inquisitive about our common species? *Dryopteris simulata* would have been described long before 1894 if fern students had known clearly from both field and herbarium study the essential characters of *D. noveboracensis* and *D. thelypteris*.

Without apology for either the questions or the exhortations, your President, who thanks you sincerely for the honor conferred upon him by re-election, suggests that by way of trying out this plan we shall all turn our attention this summer to the three species of *Dryopteris* just mentioned. The first two are within the reach of most of us, and all three have been written about a good deal during the last 25 years. Let us study these plants in the field, every phase of them, throughout the season; let us collect specimens from as diverse habitats as possible, showing all phases in size and development; let us compare the species, detail by detail, in our homes, jotting down the essential characters of each in parallel columns; and then let us send in, for publication in the JOURNAL, our observations or at least the facts new to us, or those of which we can find no record.

The benefits, aside from sharpening the powers of the individual observer, will presumably include an extension of the known range of *D. simulata*, at least, and the listing of many distinctive characters which may even require a redefinition of the other two species. Has any one found lately the exindusiate form of *D. noveboracensis* discussed long ago by Gilbert? What did D. C. Eaton write about the forms of this species? Have you ever come across *D. thelypteris* growing entirely submerged in a stream and putting out reduced leaves under water? These are the kind of things that ought to be studied by our whole membership, and the observations recorded. There should be 20 short articles by members in every issue of the JOURNAL.

Finally, we should make a practice of sending in to our Curator annually a package of selected complete specimens, with data full and accurate in every respect, for building up the Society herbarium. This should be a repository in which all our native ferns are represented by ample suites of specimens secured from every part of their range, designed to show not only local and chance variations but, what is more essential, the extremes which nearly all species attain normally in different parts of their range. In no other way than by consistent intelligent field work shall we ever know our ferns fully, either as to relationship and characters or as to distribution. This, over and above the personal profit and pleasure of fascinating field work, should be our serious purpose.

Respectfully,
WILLIAM R. MAXON, *President.*

Report of the Secretary for 1920.

There have been no special activities in the way of meetings undertaken by the Society during the past year.

Two members have died: Mrs. E. H. Bancroft and Dr. Charles Henry Holcombe. Seven members have resigned, and three have been dropped for nonpayment of dues. Twenty-four new members have been received and the membership (December 31, 1920) stands at 271, a gain of thirteen over last year, which establishes a new record for the Society. Mr. F. C. Greene changes from an ordinary to a life member.

Four amendments to the Constitution proposed by members of the council, were adopted. The text of these follows:

"Amend Article III by striking out Section 2 and substituting the following:

Applications for membership accompanied by the required fee of one dollar and fifty cents may be made at any time to the Secretary, and when so received, approved by two members of the Council, and acknowledged, the applicant shall be considered a member for the current year."

"Amend Article III by striking out Section 3 and substituting the following:

The Admission fee shall be one dollar and fifty cents, payable when application for membership is made. This fee shall also constitute the dues for the current year."

"Amend Article III by striking out Section 4 and substituting the following:

The annual dues shall be one dollar and fifty cents, payable January first of each year."

"Amend Article III by striking out Section 5 and substituting the following:

Any eligible person may become a life member on payment, at any time, of a fee of twenty-five dollars, and shall thereafter be subject to no dues or assessments. All such fees shall be held and invested as a permanent fund, the principal of which shall not be expended, but the income from which may be used for the purposes of the Society on vote of the Council. Contributions for the purpose and other available moneys may be added to this fund at the discretion of the Council."

It is hoped that the substantial increase in membership above noted may continue, and that the Society may continue to enjoy the generous support extended by its members in the past.

S. H. BURNHAM, *Secretary.*

Report of the Treasurer for 1920.

Cash on hand, Jan. 1		$186.00
Membership dues for back years	$ 4.00	
1919	12.00	
1920	227.00	
1921	29.30	
1922	1.50	
Total members dues rec'd		273.80
Subscriptions to JOURNAL, '17	2.00	
1918	2.00	
1919	.90	
1920	39.68	
1921	20.03	
Total subscriptions		64.61
Collection fees and inc.		.85
Advertising		4.25
Illustrating		25.25
Special gifts		11.50
Interest		6.00
Authors corrections		2.50
Emergency Fund (sale of Back Numbers)	51.25	
Total Receipts during 1920		440.01
Grand Total Received		$626.01

Paid out.

Secretary's expenses; postage, election of officers, etc., as per budget		$ 29.06
Treasurer's expenses, postage and printing, as per budget		15.00
Curator expenses from budget allowance		1.17
JOURNAL expenses, Printing and Illustrating, Budget	$264.00	
" " Postage, express, printing Deficit	28.18	
" " Illustrations from Illustrating Fund	3.92	
Total JOURNAL Expense		296.10
Special Gift for purposes given		1.50
Exchange		.55
Emergency Fund for rare Back Numbers to fill sets		2.00
Curators expense as provided by 1919 Budget		10.00
Total Paid out		$355.38
Balance on hand Dec. 31, 1920		270.63
		$626.01

This balance includes the following:

Emergency Fund, Jan. 1	$ 78.09	
Received	51.25	
	129.34	
Paid for rare numbers of JOURNAL	2.00	
Balance Dec. 31		127.34
Illustrating Fund, Jan. 1	1.33	
Received	8.50	
Rec'd refund for Illustrations mentioned in last report	16.75	
	26.58	
Paid out including refund to general Fund	20.67	
Balance Dec. 31	5.91	
Forward		133.25
Holding from Council order for printing herbarium Catalogue	$ 25.00	
Balance of Budget 1920 for Herbarium	8.83	
General Fund for ordinary expenses	103.52	
Total General Fund		137.35
		270.60

SPECIAL FUND CREATED BY LIFE MEMBERSHIPS AND TRANSFERS FROM EMERGENCY FUND

On hand Jan. 1, 1920	$128.97
One Life Membership	15.00
Interest received	8.69
Balance on hand Dec. 31	$152.66

After the Life Membership Dues were advanced to $25.00 the Life Member elected in January, 1920, very generously gave the Society $10.00. By action of the Council this has been transferred from the General Fund of the Society to the Special Fund.

In view of the large sales of back numbers last year, increasing our Emergency Fund to $127.34 I have proposed that $100 of this be transferred to the Special Fund. By action of the Council this has been done and we now have a really respectable Fund salted away for the unknown emergencies of the future.

With renewed thanks for the fine co-operation of members and officers I respectfully submit this report.

JAY G. UNDERWOOD, *Treasurer*.

Report of the Editors for 1920.

This year the JOURNAL has returned to its wonted prosperity in the matter of copy, which has been abundant and, as we like to have it, reasonably varied. Our great problem during the year has been to get along with printing costs which have increased about 90 per cent and an income which has not increased at all By omitting all illustrations not given and by drawing on the emergency fund, the Council has made it possible to print the usual number of pages. Next year, with the increased dues and, we trust, new memberships and subscriptions, we hope to put the JOURNAL back on the old footing. For a time, however, until we know definitely how we stand, illustrations are not to be expected in every number.

Our financial difficulties have had the gratifying effect of bringing gifts, from a number of members, principally for illustrations. For them and for the interest in the JOURNAL to which they testify, the editors are very grateful. One illustration, that in no. 3, has been provided from them and there is money enough on hand for another, which will appear as soon as a suitable subject comes to hand.

Some progress has been made in the sale of back numbers and members are again reminded that we shal not long be able to supply Volume 1 complete; also that we are in the market for any spare copies of numbers 1 and 3 of that volume.

R. C. BENEDICT,
E. J. WINSLOW,
C. A. WEATHERBY.
Editors

No report had been received from the Curator up to the time of going to press.

Dr. Charles Henry Holcombe, a member of the Society since 1897, died at Brookline, N. H., Feb. 23, 1920. Dr. Holcombe was born at Southwick, Mass., in 1859. He graduated from the Harvard Medical School in 1886 and, after two years at Milford, N. H., removed to Brookline. There he resided for all the rest of his life, winning the respect and affection of his fellow-citizens and, as a physician, building up a practice which extended to much of the surrounding country. Even in his last illness he was still ministering to patients "when he was as bad as they."

Dr. Holcombe's interest in plants and natural history in general began early in life and was never lost. The "children of the wild" appealed to him, not only by their beauty and scientific interest, but as evidence of an all-wise Creator's power and love. His "botany can" was a frequent companion in the intervals of his professional duties, and he was often wont to bring to some house-bound patient, flowers of his latest collecting in wood and meadow. A record and memorial of his botanical work remains in the large herbarium which he had formed.

New Members:

Bass, Mrs. George, 85 71st St., Brooklyn, N. Y.
Ferguson, William C., 60 Front St., Hempstead, N. Y.
Wilsie, Elmer, J., Tomkins Cove, Rockland Co., N. Y.
Youngs, Mrs. Jennie B., 309 South Seward Ave., Auburn, N. Y.

Changes of address:

Bear, Mrs. Charles U., 654 Putnam Ave., Detroit, Mich.
Fellows, Dana W., 7671 Amboy Road, Tottenville, N. Y.
Marshall, Dr. Ruth, Rockford College, Rockford, Ill.
Ridlon, H. C., Green Mountain School, Bennington, Vt.
Steil, Dr. William N., 115 South Warren St., Madison, Wis.
Wilcox, Prof. Alice W., Brenman College, Gainesville, Ga.

Mrs. Edward A. Eames, 155 Bryant St., Buffalo, N. Y., wishes to purchase a copy of Eaton's Ferns of North America.

Mr. Clarkson has interested himself in our campaign for new members to such good effect that he has added seven names to our membership list. We cannot help speculating as to the result if one in three of our entire membership should take action. We have visions of an enlarged Fern Journal with a frontispiece in color for each number issued six times per year.

The Editors tender their best thanks to Miss Ida A. Stebbins for a gift of ten dollars for illustrations.

The editors are about ready to believe in the existence of a special evil spirit whose sole business is to prevent the prompt appearance of the JOURNAL. Last year, the post office was its agent; this spring, just as no. 2 was ready and in the printers' hands, their establishment was put completely out of action by labor troubles. Not until now have we been able to issue this number. The delay is particularly unfortunate because of the suggestions for the season's work contained in the notes and reports: we can only hope that members will bear these suggestions in mind for next year.

The President has appointed the following committee to nominate officers for 1921:—Robert A. Ware, Chairman, Miss Nellie Mirick and Harold W. Pretz. Prof. C. C. Plitt will be Judge of Elections.

American Fern Journal

Vol. 11 JULY–SEPTEMBER 1921 No. 3.

North American Species of Equisetum North of Mexico.[1]

JOHN H. SCHAFFNER.

There still appears to be some confusion as to the characteristics, names, and distribution of the North American species of Equisetum. The writer has been making a study of these plants for many years, in fact ever since, as a boy, he was unable to make some of his specimens fit the descriptions in the manuals in use at the time. The greatest difficulty was experienced with *E. laevigatum* A. Br. (1), since the plant supposed to be this species did not fit the key nor the description in several fundamental respects; but because there were not enough names to go around, the specimens were accommodated with the names which seemed to fit most perfectly. After many years of uncertainty about the matter, the writer examined the original material at the St. Louis Botanical Garden, from which Engelmann had sent specimens to Braun, and found that the plants agreed quite well with Braun's description. Similar specimens from Engelmann were also shown to the writer by Underwood from the collections at the New York Botanical Garden. As a result of this study, *Equisetum kansanum* (4) was described as a new species with annual, smooth stems and cones without a point.

It also became evident that A. A. Eaton's *Equisetum hiemale intermedium* (2) was identical with the earlier

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[1] Papers from the Department of Botany, The Ohio State University. No. 129.

[Vol. 11, no. 2 of the JOURNAL, pages 33–64, plate 1, was issued Oct. 12, 1921.]

E. laevigatum. In the meantime Farwell (7) does not see to understand why the writer should take such a position. He says: "It seems rather peculiar to me that Engelmann, who supplied the material for the description and who as translator and editor of Braun's MSS, is the sponsor, in a measure, of the species, should have so misunderstood his own species as to have misapplied it and to have permitted such misapplication in our manuals without having called the attention of their authors thereto. A careful study of the original description will show that Braun's species has not been misunderstood, that his description applies to the annual-stemmed plant that has been passing under Braun's name." As to whether this latter statement is correct or not can be determined by reading Engelmann's translation of Braun (1). The species is characterized as follows:

"Equiseta stichopora (winter-Equiseta). Stomata disposed in two distinct ranges on each side of the groove: each range formed by one or more rows of stomata. (All known species in this division have hardy evergreen stems).

Homophyadica.

Ranges of stomata consisting each of one row.

7. E. laevigatum A. Braun.

Stems tall, erect, simple or somewhat branching;... sheaths elongated, adpressed, with a black limb, etc.

In size and manner of growth this new species is closely allied to *E. hyemale*, and the larger variety of *E. robustum*, but it is easily distinguished by its smoothness, its long green sheaths, with a narrow black limb, and its darker green color."

The description is quite accurate except that the color is usually not darker green than in *E. hiemale* and the sheaths are usually dilated above.

As to the statement that Engelmann might have called attention to any misplacement of the name *E.*

laevigatum, it will be remembered that, unfortunately, Engelmann had gone to his reward long before such misplacement was perpetrated by Eaton and Farwell. It was certainly not the older botanists who made the misplacement nor the present writer.

In Asa Gray's "Manual of the Botany of the Northern United States," Fifth Edition, 1868, (the first manual ever used by the writer), *E. laevigatum* Braun is traced out as follows: "Evergreen or perennial-stemmed, surviving the winter, mostly rough (the cuticle abounding in silex): fruiting in summer; spikes tipped with a rigid little point. (Stomata in regular rows, in our species on each side of the groove.) Stems tall and stout (1½°–4° or even 6° high), simple or casually branched, evenly many-(15–40-) grooved: sheaths appressed.... Smooth or minutely roughish with minute tubercles; sheaths elongated," etc.

This is again a fairly accurate diagnosis except that the sheaths are not appressed when compared with *E. praealtum*, for example.

Practically the same treatment was given in the 6th edition of Gray's Manual, in Underwood's "Our Native Ferns," in Britton and Brown's Illustrated Flora, in Small's Flora of the Southern United States, in Piper and Beattie's Flora of Southeastern Washington and Adjacent Idaho, and by various other authors. In fact, all of these authors seem to have understood Engelmann's treatment alike, and it is, therefore, quite interesting to read Farwell's insistence on following "descriptions" when he utterly fails to do so himself.

Equisetum does not fall into two clearly defined natural groups. It is out of the question to establish a genus Hippochaete. The distinctions are not sharp enough for two sub-genera or sections since there are always transitional species. One can make a number of subsections but these are too closely allied, according to

the writer's opinion, to be established as sub-genera. None of the important characters, such as apiculate cones, evergreen stems, branching systems, distribution of stomata, and character of sheaths, give distinct segregations. As Clute stated a number of years ago in his "Fern Allies," "The manner of growth, the structure of the stem, and the method of fruiting are the same in all."

Below is given a list of North American species on a conservative basis. Varieties, fluctuations and hybrids will not be considered in the present paper. Fluctuations are to be seen everywhere but there are few varieties so called that are distinct altho many have been described. Some forms described as species may be good varieties and there are apparently several hybrids.

The writer is under obligations to William R. Maxon of the Smithsonian Institution for assistance in verifying certain references given in the list of species.

SECTIONS OF THE GENUS EQUISETUM.

I. Cones tipped with a rigid point; aerial stems perennial, with regular whorls of branches; stomata commonly in bands of two or more regular rows each, some with single rows of stomata.

EQUISETA PRIMITIVA.

Mostly tropical species; none in our region.

II. Cones tipped with a rigid point; aerial stems perennial, usually without whorls of branches except when the main stems are broken, but often much branched below the ground, at the surface, or rarely from the lower nodes above ground, commonly tufted; stomata commonly in single rows, rarely with bands of two or more rows.

EQUISETA HIBERNA.

E. laevigatum A. Br., *E. praealtum* Raf., *E. hiemale* L., *E. variegatum* Schleich., *E. scirpoides* Mx.

III. Cones without a point, rounded or merely acute at the tip; aerial stems annual in regions of frost, usually unbranched unless broken, but occasionally with whorls of short branches on the fertile ones, usually tufted and sometimes also with a rosette-like mass of branches about the base of the fertile ones; stomata in regular rows, the rows sometimes double.

EQUISETA AMBIGUA.

E. kansanum Schaffn., *E. funstoni* A. A. Eat.

IV. Cones without a point; aerial stems annual, all green, with or sometimes without whorls of branches at the nodes; stomata in regular lines or bands in the grooves.

EQUISETA AESTIVALIA

E. fluviatile L., *E. palustre* L.

V. Cones without a point; aerial stems annual, of two kinds, sterile ones much branched and green, and fertile ones yellowish or brownish in color with little or no chlorophyll before the spores are matured and either withering at the tip and developing green branches below, or withering completely after the spores are shed; stomata scattered in bands or irregular rows in the grooves or entirely absent on the internodes of the fertile shoots.

EQUISETA HETEROPHYADICA.

E. silvaticum L., *E. pratense* Ehrh., *E. telmateia* Ehrh., *E. arvense* L.

PHYLETIC SYNOPSIS OF EQUISETUM, NORTH AMERICAN SPECIES NORTH OF MEXICO.

I. Cones tipped with a rigid point, the termination of the floral axis; aerial stems evergreen.

A. Sheath segments and deciduous teeth sharply differentiated; aerial stems usually tall and rigid, usually many-grooved (10–48); central cavity of the internode large.

1. Sheaths elongated, dilated above so as to appear more or less funnel-shaped, green in age, with a black or brown limb, sometimes with a dark band below; sheath segments slightly tricarinate; stems rather smoothish. *E. laevigatum.*

2. Sheaths short, cylindrical, appressed, ash-colored or black in age, often with a black ring around the limb and a second one at the base, not dilated above except when young, but frequently split in age; stems very rough.

a. Ridges of the stem with one row of tubercles; sheath segments without a central groove or sometimes with a minute groove, normally tricarinate. *E. praealtum.*

b. Ridges of the stem with two rows of tubercles; sheath segments with a deep central groove, normally quadricarinate. *E. hiemale.*

B. Sheath segments and teeth not sharply differentiated, the base of the teeth usually persistent, but the bristle tips deciduous; stems low and slender, tufted, usually 10-grooved or less, solid

or the central cavity only one-half to one-third the diameter of the internode.

1. Stem with central cavity, sheaths 5–10-toothed; sheath segments usually quadricarinate. *E. variegatum.*
2. Stem solid, mostly 6-grooved; sheaths 3-toothed; sheath segments somewhat quadricarinate. *E. scirpoides.*

II. Cones rounded at the top or merely acute, not with a rigid point; aerial stems annual, not surviving the winter in regions of frost.

A. Aerial stems all green and essentially alike.

1. Fertile stems usually not branched above ground but sometimes developing whorls of minute branches while the cones are maturing; stems with cross bands of silex; plants of dry or ordinary wet soil.
   a. Not with numerous branched basal sterile shoots around the fertile shoots; stems very smooth, with cross bands of silex; limb of the long green sheath dilated upward, with a narrow black band at the top, not incurved. *E. kansanum.*
   b. With a cluster or rosette of small, branched, sterile shoots around the base of the fertile shoots; stems very rough with cross bands of silex; limb of the rather short sheath strongly incurved with age, with a narrow black band at the top; stomata often in two rows. *E. funstoni.*
2. Fertile stems branched, usually with numerous whorls of branches; plants of wet soil or growing in the water.
   a. Sheaths usually appressed: stem 1½–3 ft. high, usually many-grooved, with a large central cavity in the internode. *E. fluviatile.*
   b. Sheaths loose and somewhat dilated; stems ½–1½ ft. high, slender, 5–10-grooved; central cavity rather small. *E. palustre.*

B. Aerial stems of two kinds, the sterile shoots green and much branched, the fertile brown and at least at first with little or no chlorophyll.

1. Fertile shoots producing branches after the maturity of the spores, only the tips withering.
   a. Branches of the sterile and fertile shoots compound, curved downwards. *E. silvaticum.*
   b. Branches of the sterile and fertile shoots simple and straight. *E. pratense.*
2. Fertile shoots withering after the spores are shed, rarely producing branches.

a. Sterile stem ivory white or brownish, 2–10 ft. high, its branches several-angled, terete; fertile stem usually 1–2 ft. high, robust, the internodes usually without stomata, the sheaths including the 20–30 long teeth 1½–2 in. long; cone 2–3 in. long, its axis hollow. *E. telmateia.*

b. Sterile stem green or brownish in age, usually less than 2 ft. high, its branches sharply 3-or 4-angled; fertile stem ½-1 ft. high, the internodes with stomata, the sheaths including the 7–15 teeth ¾–1½ in. long; cone 1–1½ in. long, its axis solid when young. *E. arvense.*

LIST OF NORTH AMERICAN SPECIES.

1. EQUISETUM LAEVIGATUM A. Br. Am. Jour. Sci. **46**: 87. 1844. Smooth Scouring-rush.

E. hiemale intermedium A. A. Eat.

Type locality: "On poor clayey soil, at the foot of the rocky Mississippi hills, on the banks of the river below St. Louis," Missouri.

In various situations, commonly on flood plains, along streams and rivers; rather open in its growth.

Conn., N. Y., and Ont. to B. C., south to Cal., N. Mex., Tex., La., and N. C.

2. EQUISETUM PRAEALTUM Raf. Florula Ludoviciana 13. 1817. Great Scouring-rush.

E. robustum A. Br. *E. affine* Engelm. *E. ferrissi* Clute.

Type locality: "Banks of the Mississippi River," Louisiana.

Mostly on moist, usually alluvial soil especially along brooks, creeks, and rivers commonly forming dense masses or sod-like stands.

Conn. and Quebec to B. C. southward nearly throughout the United States to Cal., Northern Mex., La., and N. C.

3. EQUISETUM HIEMALE L. Sp. Pl. 1062. 1753. Rough Scouring-rush.

Incl. *E. hiemale californicum* Milde.

Type locality: "Habitat in Europae sylvis, aspris, uliginosis."

In wet places and on river, creek, and lake banks.

Europe, Northern Asia, Japan, and Alaska; in N. Am. south to central Cal. and western Mont.

4. EQUISETUM VARIEGATUM Schleich. Cat. Pl. Helvet. 27. 1807. Variegated Scouring-rush.

E. trachyodon A. Br. *Hippochaete nelsoni* (A. A. Eat.) Farw.

Type locality: Switzerland.

In wet meadows, bogs, and alluvial thickets, especially in sandy places.

Circumpolar, north temperate zone and extending into the Arctic zone to beyond 80° N. lat.; Europe, through northern Asia, Alaska, Labrador, and Greenland; in N. Am. south to Conn., Ohio, Ill., Neb., Colo., and Ore.

5. EQUISETUM SCIRPOIDES Mx. Fl. Bor. Am. 2: 281. 1803. Dwarf Scouring-rush.

Type locality: "Hab in vetustis sylvis Canadae."

In low fields, swamps, and moist coniferous woods.

Circumpolar, north temperate zone, extending beyond the Arctic circle; Europe, northern Asia, and Alaska to Greenland; in N. Am. south to Conn., Penn., Mich., Ill., Mont., and Wash.

6. EQUISETUM KANSANUM Schaffn. Ohio Nat. 13: 21. 1912. Kansas Scouring-rush.

E. laevigatum according to A. A. Eaton, not A. Braun.

Type locality: "Bloom township, Clay County, Kansas."

Commonly growing in clay soil on banks of ravines and on bluffs.

Mainly in the western Mississippi basin; Ohio to Mont. and B. C., south to Cal., Ariz., N. Mex., and Mo.

7. EQUISETUM FUNSTONI A. A. Eat. Fern Bull. 11: 10. 1903. Funston's Scouring-rush.

E. mexicanum of authors, not Milde.

Type locality: Southern California.

In moist to dry sandy soil, especially along streams.

Santa Barbara and Inyo counties, Cal. southward, probably into Mex.

8. Equisetum fluviatile L. Sp. Pl. 1062. 1753. Water Horsetail.

E. limosum L. *E. heleocharis* Ehrh. *E. uliginosum* Muhl.

Type locality: "Habitat in Europa ad ripas lacuum, fluviorum.'

Usually in swamps and the margins of ponds and lakes in water up to two or more feet in depth.

North temperate zone; Europe and Asia, through Alaska to Labrador and Newf., south in N. Am. to Ore., Wyo., Neb., Va., and Conn.

9. Equisetum palustre L. Sp. Pl. 1061. 1753. Marsh Horsetail.

Type locality: "Habitat in Europae aquosis."

In wet places.

North temperate zone; Europe to Japan, Alaska, and Newf., south in N. Am. to Conn., N. J., Ill., Wyo., and San Mateo County, Cal.

10. Equisetum sylvaticum L. Sp. Pl. 1061. 1753. Wood Horsetail.

Type locality: "Habitat in Europae septentrionalis pratis sylvaticis."

In moist sandy woods and thickets.

Circumpolar, north temperate zone, extending beyond the Arctic circle; Europe and northern Asia to Alaska, Labrador, and Greenland; in N. Am. south to Conn., N. Car., W. Va., Ohio, Iowa, S. Dak., and Mont.

11. Equisetum pratense Ehrh. Hannov. Mag. 22: 138. 1784. Meadow Horsetail.

E. umbrosum Willd. *E. triquetrum* Bory. *E. drummondii* Hook.

Type locality: "Bei Stiege, in Fuerstenthum Blankenburg" "auf den Wiesen," Germany.

In sandy meadows, and alluvial soil.

North temperate zone; British Isles, Europe, Siberia, and Alaska to Nova Scotia; in N. Am. south to Conn., N. J., Iowa, and Colo.

12. EQUISETUM TELMATEIA Ehrh. Hannov. Mag. 287. 1783. Ivory Horsetail.

E. maximum Lam. *E. majus* Gars.

Type locality: Europe.

In various situations, especially in moist shady margins of woods. Europe and western Asia, western North Africa, and in N. Am. from B. C. to southern Cal.

13. EQUISETUM ARVENSE L. Sp. Pl. 1061. 1753. Field Horsetail.

E. saxicola Suksd. *E. boreale* Bong.

Type locality: "Habitat in Europae agris, pratis."

In various situations, especially in sandy soil and on railway embankments.

Circumpolar, north temperate and Arctic zones, reaching beyond the 80th parallel of north latitude; Europe, Northern Asia to the Himalaya Mts. and Japan; north Africa, south Africa; in N. Am., Alaska to Greenland, south to S. C., northern Mex., and southern Cal.

LITERATURE CONSIDERED IN THE PRELIMINARY DISCUSSION.

1. BRAUN, ALEXANDER. A Monography of the North American species of the genus Equisetum; translated from the author's manuscript, and with some additions, by George Engelmann. Am. Jour. Sci. and Arts **46**: 81–91. April, 1844.

2. EATON, A. A. A New Equisetum. Fern Bull. **10**: 120–122. 1902.

3. EATON, A. A. The Genus Equisetum in North America—XII. Fern Bull. **11**: 7–12. 1903.

4. SCHAFFNER, JOHN H. An Undescribed Equisetum from Kansas. Ohio Nat. 13: 19–22. 1912.

5. BUSH, BENJAMIN FRANKLIN. Standley's Ferns of Greene Co., Mo. Am.Fern Jour. 6: 112–116. 1916.

6. FARWELL, OLIVER ATKINS. The Genus Hippochaete in North America North of Mexico. Mem. N. Y. Bot. Gar. 6: 461–472. 1916.

7. FARWELL, OLIVER ATKINS. Notes on Hippochaete. Am. Fern Jour. 7: 73–76. 1917.

OHIO STATE UNIVERSITY.

TAXONOMIC AND GEOGRAPHIC STUDIES IN NORTH AMERICAN FERNS.

III. Pellaea glabella and its Western Segregates.

FREDERIC K. BUTTERS.

As stated recently in a note in the Fern Journal,[1] a further study of the western ferns allied to *Pellaea glabella* Mett. ex Kuhn has convinced me that there are two species occuring in the western states and Canada, closely allied to that well-known northeastern fern, but clearly distinguished from it, and from each other by numerous characters and by their geographical range. One of these, *Pellaea pumila* Rydb., originally described independently by Rydberg from the Black Hills of South Dakota,[2] and by Elias Nelson from Wyoming,[3] occurs along the eastern ranges of the Rocky Mountains from Alberta to Wyoming, the other, my *Pellaea Suksdorfiana*, appears to be confined to the region west of Rocky Mountains, occurring chiefly in the intermontane region, and ranging from British Columbia to

[1] Am. Fern Journ. 11: 39–40. 1921.
[2] Mem. N. Y. Bot. Garden, 1: 4. 1900.
[3] Fern Bull. 7: 30. 1899.

Arizona and New Mexico. It is the purpose of this paper to point out in detail the differences between these three closely related species.

Externally, the three species are fairly easy to distinguish. *P. glabella* is the largest, the fronds measuring up to 25 cm. in length (including the stipe) and, except in obviously depauperate plants, seldom measuring less than 12 cm. In *P. Suksdorfiana* the average length of the frond is 9.5 cm. and it seldom exceeds 12 cm. In one of the Suksdorf specimens listed below the longest frond is 20 cm. long, but this is the only specimen seen which has any fronds over 15 cm. long. *P. pumila* is even more dwarf, the average length of the frond being 6.8 cm., and the longest seen, 14 cm.

In *P. glabella*, except in very young or depauperate plants, the fronds are twice compound. The lowest pair of pinnae, which are the largest, are 3–5-foliolate, the second and third pairs are frequently compound also, and occasionally even pinnae higher up in the frond. The terminal pinnule of a compound pinna is stalked, the lateral pinnules are often over half of the length of the terminal one and closely resemble the small pinnae of the first order which occur towards the tip of the frond. Semi-compound pinnae occur frequently between the completely compound basal, and the simple upper pinnae. In these, the basal lobes, corresponding to the lateral pinnules of compound pinnae, are variously shaped, usually acute, and $^1/_4$–$^1/_2$ the length of the central lobe. They are often asymmetrical, with the *posterior* basal lobe better developed than the anterior. Rarely one of the basal lobes is reduced to a mere auricle, and very rarely indeed both basal lobes are so reduced.

P. Suksdorfiana shows much less tendency to form twice compound fronds than *P. glabella* of similar size. Frequently the pinnae are simple throughout, but occasionally the one or two lower pairs of pinnae are 3-

foliolate (very rarely 5-foliolate). In such pinnae the middle pinnule is twice as long as the lateral ones. In semi-compound pinnae the basal pinnules are commonly represented merely by basal auricles, which, in marked contrast to *P. glabella*, are frequently found on both sides of the pinna. Even when compound, the basal pinnae are often smaller than the second pair, and they frequently wither early, so that in many specimens only their petiolules remain. This characteristic tends, of course, to conceal the twice pinnate character of the fronds in many cases.

In *P. pumila* the fronds of the smaller specimens are usually strictly once-pinnate. Those of larger specimens have one or two pairs of nearly compound 2–3-foliolate pinnae. In these the terminal pinnule is not distinctly stalked, but is narrowed at the base, which is confluent with the one or two lateral pinnules, which are less than ½ as long as the terminal one. The *anterior* basal pinnule is often better developed than the posterior, and unilateral (mitten-shaped) pinnae are very common. The basal lobes are very rarely reduced to auricles.

Though somewhat variable, the shape of the simple pinnae is characteristic in each species. In *P. glabella* they are oblong-linear, rarely somewhat lanceolate, obtuse and pseudomucronate[4] or somewhat acute at the apex, and often cordate at the base. The lower ones have stalks about 0.5 mm. long. In *P. Suksdorfiana* they are lanceolate or oblong-lanceolate, obtuse or somewhat acute and rarely pseudomucronate at the apex, and cuneate or narrowed to the base. The lower ones have stalks 1–2 mm. long. In *P. pumila* they are ovate (rarely elliptical, ovate-lanceolate, or lanceolate), obtuse at the apex, and truncate or abruptly cuneate at the base. All are sessile, or the lowest may have very short stalks, less than 0.5 mm. long.

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[4] The apparent mucro is formed by the straight tip of the leaflet, while on each side of the tip the margin is abruptly folded in to form part of the indusium.

The leaves of *P. glabella* are very bluish green, with the lower surface distinctly punctate, and bearing a few hair-like scales along the midrib. When mature, the leaves are rather thick, and have very obscure veins, which leave the midrib at a narrow angle, fork about twice, and in the outer part of the leaflet make an angle of about 60° with the midrib. The midrib itself is marked by a slight ridge on the upper side of the leaflet, and is very obscure below. The leaves of *P. Suksdorfiana* are much less blue, the lower surface of the leaflets is somewhat less obviously punctate, and is glabrous. The veins are somewhat conspicuous by transmitted light, leaving the midrib at a narrow angle, forking about twice, and in the outer part of the leaflet making an angle of about 45° with the midrib. The midrib is marked by a slight groove on the upper side of the leaflet, and is somewhat prominent below. The leaves of *P. pumila* are less blue than those of *P. glabella*, the lower surface of the leaflets is not punctate, or at most very obscurely so, and is glabrous. The veins are somewhat more obscure than in *P. Suksdorfiana*, and are about once forked. They leave the midrib at an angle of 30°-45,° and in the outer part of the leaflet make an angle of about 60° with the midrib. The midrib is scarcely visible on the upper side of the leaflet, and is obscurely ridged below.

The whole indusium of *P. glabella* is 0. 7–1. 3 mm. wide, with a nearly entire hyaline margin 0. 2–0. 3 mm. wide. It reaches very close to the tip of the leaflet, or may even extend across the tip from one side of the leaflet to the other. The band of sori is narrow, and is situated on the back of the leaflet close to the angle between the leaf surface and the indusium. Accordingly the sporangia are seldom conspicuous, even in mature fronds. In *P. Suksdorfiana* the indusium is somewhat

narrower, 0. 7–1. 0 mm. wide with a sharply crenulate hyaline edge about 0. 1 mm. wide. It generally ends 0. 5–1. 0 mm. below the tip of the leaflet, though rarely extending to the very tip as in *P. glabella*. The sori cover a band nearly 1 mm. wide, and the sporangia are very conspicuous in mature fronds. In *P. pumila* the indusium is 0. 8–1. 1 mm. wide, with a somewhat crenulate border about 0. 2 mm. wide. The band of sori is somewhat narrower than in *P. Suksdorfiana*, and often extends beyond the point of inflexion of the indusium so that part of the sporangia are borne on the under side of the indusium. They are accordingly better covered and less conspicuous than in *P. Suksdorfiana*.

As between the two western species, perhaps the most clearly diagnostic characters are found in the spores. In an earlier paper[5] I stated that *P. pumila* has only tetrahedral, and *P. Suksdorfiana* only elliptical spores. Examination of further material has proved this statement erroneous, though spores of other form are in each case comparatively rare. The spores of *P. pumila* are much smaller than those of *P. Suksdorfiana* even when comparison is made between spores of similar form. The tetrahedral spores of *P. pumila* vary from 29 × 38 μ–47 × 55 μ, the mean size being 39 × 45. 5 μ; the few elliptical spores are 36 × 47 μ–40 × 55 μ. The tetrahedral spores of *P. Suksdorfiana* measure 50 × 58 μ–61 × 66 μ, the much more abundant elliptical spores are 50 × 58 μ–64 × 80 μ, with the mean size 58 × 70 μ. While the extremes of the two species approach rather closely, it is to be noted that these extreme measurements apply to only a few scattering spores. In no case has the mean length of the spores in any mount of *P. pumila* exceeded 55 μ, or that of any mount of *P. Suksdorfiana* been less than 65 μ. As regards spore characteristics, *P. glabella* occupies a position somewhat intermediate between the two western species, but more closely resembling *P.*

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[5] Am. Fern Journ. **7**: 77. 1917.

Suksdorfiana. The stipes of the three species differ in both external appearance and internal structures. Those of *P. glabella* are dark red-purple, becoming almost black in old age; those of *P. Suksdorfiana* are somewhat lighter in tone, and more reddish brown, while those of *P. pumila* are rather bright chestnut brown, becoming darker in old age, but entirely without any purple tinge. Those of the last mentioned species differ also from the others in their great brittleness, a character which has led to some confusion between this species and *P. Breweri*.

The most characteristic microscopic differences in the stipes are in the epidermal and immediately subjacent layers of cells. The stipes of *P. glabella* have fibrous epidermal cells, which are of rather even size and uniformly very thick-walled (average size in cross-section, 12 × 19 μ, with the lumen 3 μ or less in width). The hypodermal cells are mostly similar, but slightly larger and less thick-walled, and some similar cells occur in the third layer. In *P. Suksdorfiana* the epidermal cells are less uniform, 8 × 11 μ–19 × 22 μ in cross-section, moderately thick-walled with the thickening heaviest on the outer wall, and with the lumen 3.5–5.5 μ wide. The hypodermal cells are somewhat thick-walled, but otherwise resemble the internal parenchyma rather than the epidermis. In *P. pumila* the epidermal cells are nearly circular in cross-section, 9–15 μ in diameter, moderately and uniformly thick-walled with the lumen 4–7 μ wide. The hypodermal layer, with the exception of a few scattered fibrous cells, consists of thin-walled parenchymatous cells.

The vascular bundle of the stipe, and particularly the form of the xylem, is quite distinctive in the three species, though there is enough variation between larger and smaller stipes, and between the proximal and distal parts of the same stipe to confuse somewhat the points of difference. In all the species the xylem con-

sists of a central mass, often cleft along the median plane, and of lateral wings extending outward and towards the ventral side of the stipe. In *P. glabella* these wings are relatively large and widely extended, so that the xylem bundle has in cross-section the outline of a very flat V. The whole vascular bundle is somewhat reniform in cross-section, or merely flattened on the ventral side. In *P. Suksdorfiana* the wings of the xylem are somewhat shorter, and at first extend horizontally, then curve sharply towards the ventral side of the stipe, and may even be completely inflexed at the tip. The whole vascular bundle has a distinctly reniform cross-section. In *P. pumila* the wings of the xylem are still shorter, and directed towards the ventral side of the stipe, the xylem mass is very compact, and the whole vascular bundle is nearly circular in cross-section.

In my earlier paper I cited the specimens of the two western species which are in the Gray Herbarium. The following specimens from the National Herbarium (N) and the Herbarium of the University of Minnesota (M) have been examined in the preparation of the present paper:

Pellaea pumila: SOUTH DAKOTA: Bull Springs west of Custer, *P. A. Rydberg*, no. 1191 (N); Deadwood, crevices in white rocks, *C. R. Ball*, no. 1688 (N).

WYOMING: Laramie Hills, Albany Co., *A. and E. Nelson* no. 6837 (N); Loomis Creek, Natrona Co., dry cracks in cliffs, *Leslie N. Gooding* no. 183 (N two sheets): Mammouth Hot Springs, Yellowstone Park, dry cracks in cliffs alt. 6000 ft., *F. H. Burglehaus* (M two sheets, and N).

MONTANA: Bozeman, limestone cliffs 5000 ft., *J. W. Blankinship* no. 638 (N); Belt Mts., *R. S. Williams* no. 241 (N).

ALBERTA: Banff, limestone cliff at base of Tunnel Mt. *F. K. Butters* (M).

Pellaea Suksdorfiana: ARIZONA: San Francisco Mts., 9000 ft., *D. T. MacDougal* (M); Jacob Lake, Kaibab

National Forest, alt. 8000 ft., *D. F. Korstian and F. S. Baker* (N).

UTAH: In crevices of rocks near Kanab, *Ivar Tidestrom* no. 2284 (N); Armstrong and White Canyons near the Natural Bridges, alt. 1600–1800 m., *P. A. Rydberg and A. O. Garrett* no. 9421 (N); Three Lakes, Kane Co., alt. 1800 m. *W. W. Eggleston* no. 10243 (N).

WASHINGTON: Klickitat Co., on cliffs near the Columbia, *W. N. Suksdorf* no. 2083 (M and N, two sheets); cliffs east of Bingen, Klickitat Co., *W. N. Suksdorf coll., ex herb. F. L. Pickett* no. 561 (N), a different collection from the above, but apparently from the same locality.

BRITISH COLUMBIA: Carbonate Draw [Upper Columbia Valley] *Edw. R. Heacock in Shaw's Selkirk Flora*, no. 272 (M).

While a large number of specimens of *Pellaea glabella* have been examined, they all fall within the geographical range delimited in my former paper on that species.

UNIVERSITY OF MINNESOTA.

A List of Ferns found in New Hampshire.

CHARLES S. AND WILLIAM F. LEWIS.

These ferns were found during the summers of 1916 and 1918 in four localities: a. The northeastern corner of Lake Winnepesaukee near Melvin Village, 1916. This includes Mt. Shaw. b. The neighborhood of North Woodstock and the mountains near that village, 1916. c. The neighborhood of Whitefield, 1918. d. The Presidential Range, including especially Mt. Washington approached from the Castellated Trail and King's Ravine, 1918: also Owl's Head, Cherry Mt. The names are in the order of the seventh edition of

Gray's Manual. Identifications have been carefully checked and in the case of *Dryopteris spinulosa* and its varieties and of hybrids, have been tested by microscope.

Polypodium vulgare L. This was found in all localities, save the upper reaches of Mt. Washington: abundant. The var. *sinuatum* was found at Georgiana Cascade, North Woodstock and on Owl's Head at Cherry Mt., near the Presidential Range. The var. *deceptum*, or a closely similar form, was found at the Cascade.

Phegopteris polypodioides Fée. In all localities, especially on the Presidential Range: frequent to common.

Phegopteris hexagonoptera (Michx.) Fée. Melvin Village.

Phegopteris Dryopteris (L.) Fée. All four localities: not uncommon.

Adiantum pedatum L. On lower levels everywhere, but not on the mountains: never common, but frequent.

Pteris aquilina L. Common everywhere. There was a station near Whitefield in which the fronds approached the long, irregular cuttings of the var. *pseudocaudata*.

Asplenium platyneuron (L.) Oakes. Only near Melvin Village.

Asplenium Trichomanes L. Only at Whitefield.

Athyrium acrostichoides (Sw.) Diels. In all localities: fairly frequent.

Athyrium angustum (Willd.) Presl. Common in all localities. The var. *rubellum*, Whitefield; var. *confertum*, Whitefield.

Polystichum acrostichoides (Michx.) Schott. Common everywhere. The var. *incisum* at Whitefield.

Polystichum Braunii (Spenner) Fée. On a spur of Bowman's Ridge, one plant, on the trail to Mt. Jefferson.

Dryopteris Thelypteris (L.) Gray. Common everywhere, even on the Presidential Range.

Dryopteris noveboracensis (L.) Gray. Melvin and Whitefield: not common.

Dryopteris marginalis (L.) Gray. Fairly common everywhere, save on the Presidential Range. A frond. picked and dropped in the pathway, was found at the foot of the trail near Randolph, evidently growing somewhere near; but we found no plants of this species on the entire range.

Dryopteris Boottii (Tuckerm.) Underw. Common at Whitefield.

Dryopteris cristata (L.) Gray. Whitefield and Melvin: common in swamps at both places.

Dryopteris Clintoniana (D. C. Eaton) Dowell. Frequent at Whitefield; rare at Melvin.

Dryopteris intermedia (Muhl.) Gray. Common at all localities. Some particularly fine specimens were growing at Whitefield.

Dryopteris spinulosa (O. F. Mueller) Ktze. All four localities; especially interesting at the upper levels of Mt. Washington, e. g., Edmand's Col.

Dryopteris spinulosa, var. *americana* (Fisch.) Fernald. Not uncommon on the mountains, especially at Mt. Shaw, Melvin Village and Laurie's Knob, near Whitefield.

Specimens of the following Dryopteris hybrids are in our collection: *D. Clintoniana* × *intermedia*, *D. Clintoniana* × *spinulosa*, *D. cristata* × *spinulosa*, *D. intermedia* × *spinulosa*, *D. marginalis* × *spinulosa*. All are from Whitefield.

Cystopteris fragilis (L.) Bernh. Melvin, Whitefield, North Woodstock, but none in the Presidential Range district.

Woodsia ilvensis (L.) R. Br. Mt. Shaw, especially Bald Knob, Melvin; abundant: Dalton Mt., near White field: Mt. Lincoln, near North Woodstock.

Dennstaedtia punctilobula (Michx.) Moore. Common everywhere.

Onoclea sensibilis L. Common everywhere. The var. *obtusilobata* at Whitefield and Melvin.

Onoclea Struthiopteris (L.) Hoffm. Melvin and Whitefield: not common.

Osmunda regalis L. Melvin, Woodstock and Whitefield: not abundant.

Osmunda Claytoniana L. Everywhere, frequent.

Osmunda cinnamomea L. Everywhere, common. The var. *incisa* J. W. Huntington at Whitefield; a small group of plants.

Ophioglossum vulgatum L. Whitefield; Dalton Mt. (Whitefield); Melvin Village. The fronds found at Melvin, growing in an abandoned barnyard, were eleven to thirteen inches long in many cases.

None of the woodland Botrychiums were found anywhere; nor did we find any of any kind in the Woodstock or Melvin districts.

Botrychium dissectum Spreng. Whitefield.

Botrychium obliquum Muhl. Whitefield. The var. *oneidense* at Whitefield.

Botrychium ternatum (Thunb.) Sw., var. *intermedium* D. C. Eaton. Whitefield. The var. *rutaefolium* at Whitefield (?).

Botrychium virginianum (L.) Sw. Melvin and North Woodstock, abundant. Whitefield: rare, only one sterile frond found.

Summary: Melvin and neighborhood, 31 species, 2 varieties; North Woodstock, 20 species, 2 varieties; Whitefield, 28 species, 5 varieties; Presidential Range, 16 species, 0 varieties. Of these 9 species and one variety were found on the upper levels. Of the total (34 species, 10 varieties and 5 hybrids), 20 species were found in all the localities (omitting the Presidential Range).

TRENTON, N. J.

An Interesting Trip.

E. W. GRAVES.

It was in the month of May, 1917, the time when everything is bursting with new life, when nature is dressing in her best as if for a special occasion. The woods were full of singing birds and blooming flowers, and the ferns were flaunting high their lacey fronds welcoming the lover of nature to their haunts.

For two reasons I made this trip. One was to explore new territory, and the other was to revisit Bucks Pocket, Ala., where I had found *Trichomanes petersii*, to see how it looked in spring-time, also to get live specimens for members who had requested them.

I left home at daylight traveling at a brisk walk to see how far I could go in an hour. After covering three miles I crossed Miller creek, where, just a mile below I knew was the beautiful fall under whose protection grew large patches of *Trichomanes boschianum* Sturm, and where today I would not be surprised to find *Trichomanes petersii* establishing itself, for on my return I set several bunches of that fern which I brought back with me from Bucks Pocket. I walked another mile before the first hour had expired. Four miles in one hour is not so bad. After crossing Miller creek I came upon a colony of pitcher plants, *Sarracenia catesbaei* Ell. I had found them before but here were some nice specimens a few of which I put in my press. Traveling on for several hours I came to the town of Rosalie. By this time it was nearly noon. After eating a hasty lunch I passed on and came to Brier creek where a little surprise was awaiting me. By the roadside I saw several trilliums which were new to me. After reaching home I found them to be the southern trillium, *Trillium stylosum* Nutt. I had never found the plant before, therefore I collected a good supply of them.

Going a little farther I came upon thousands of them. On either side of the road the woods seemed to be full of them, of all hues from almost white to a deep pink or rose color. I never had seen such beautiful trilliums before. I was loath to leave but I must pass on for I was not half way to Bucks Pocket yet. When I stopped for the night I had traveled almost forty miles.

In the morning being somewhat rested I went on to the deep gorge which is called the pocket. I crossed over and went directly to the place where the little fern grew, finding it looking much fresher than it was the fall before. After gathering a good supply of specimens, I proceeded to explore other portions of the gorge, finding a number of plants I had not seen there before: among them were *Trillium erectum* L., *Phlox paniculata* L., *P. divaricata* L., *Asplenium angustifolium* Michx. and *Camptosorus rhizophyllus* (L.) Link. Specimens of the latter were more than a foot long, the largest I have ever found. They were growing in moss on damp stones. The plants of *Asplenium angustifolium* Michx. were the first I had found in the State. They were growing among stones in dense shade. I had found it in the rich alluvial bottoms of the Tennessee river valley across the line in Tennessee, but I had never expected to find it growing on Sand Mt. The soil of Bucks Pocket is of a calcareous nature, giving reason for it and Camptosorus being found there.

After spending some time collecting I started on my return journey, taking another road that I might traverse new territory. I crossed the upper branch of Sauty creek which empties into the Bucks Pocket gorge. Along the banks I saw beautiful rhododendrons in bloom, for May is the month of rhododendrons. From here I turned my course east toward Fort Payne, the county seat of DeKalb Co. Fort Payne is thirty miles southwest of Trenton, Ga. Near the later place

I have found many plants of *Asplenium pinnatifidum*, and *A. bradleyi*. The same deep valley which separates Sand Mt. from Lookout Mt. extends from Fort Payne to Trenton. On both sides of this valley are high precipitous walls of rocks. On these rock walls is where *A. pinnatifidum* and *A. bradleyi* are to be found. I wanted to explore these cliffs near Fort Payne to see if these two spleenworts were as plentiful there as at Trenton. Reaching the cliffs I searched for some distance along the road which leaves the mountain at this place, finding a number of plants of *A. pinnatifidum*, but found none of *A. bradleyi*. I could not spend as much time as I would like, as I wanted to take the train for Trenton, for I felt I had walked far enough.

As I left Sand Mt. I noted a change in the flora. As the sandstone gave way to limestone, *Pellaea atropurpurea* and *Asplenium parvulum* began to appear, as these plants prefer limestone to sandstone.

Taking the train I soon reached Trenton, and after a seven mile walk reached home, ending one of my most interesting tramps.

STOCKPORT, IA.

Some Recent Fern Literature.

MAXON, W. R. New selaginellas from the western United States. Smithsonian Misc. Coll. **72**: no. 5. pl. 1–5. 22 Dec. 1920.

In the paper bearing the above title, Maxon presents descriptions of six undescribed species of *Selaginella*. Five of these are from southwestern United States; the sixth from Montana. It will be of interest to American fern collectors to list here the names and type localities specifically. All are described at length and well illustrated by half tone reproductions of whole plants.

S. mexicana; Organ Mts., N. Mexico,
S. eremophila; Mountain Spring, San Diego Co., California,
S. arizonica; Santa Catalina Mts., Arizona,
S. asprella; San Antonio Mts., California,
S. leucobryoides; Providence Mts., California.
S. Standleyi; Glacier National Park, Montana.

All these new species represent segregates from the mass of forms formerly included under *rupestris*. Their differentiation now merely follows the gradual accumulation of more material, extensive field study, and discriminating study in the laboratory. Some doubtful forms still remain, for the proper placing of which more material is needed; the attention of members who may be able to help is especially called to Mr. Maxon's request for specimens from the southern and western United States.

CHRISTENSEN, CARL. Dryopteris species and varieties novae. Repertorium Nov. Sp. **15**: 24-26. 1917.

Discusses a new species, *D. rupicola*, and varieties of *D sancta* from Santo Domingo.

BRITISH FERN GAZETTE, Vol. 4. no. 6. June and September, 1920.

Reports a resumption of annual meetings, a doubling of subscription, and includes accounts of fern varieties, and methods of culture of the sort dear to the British amateur fern student.

Mrs. E. D. W. Brown[1] has described in detail eight cases of apogamy which occurred in prothallia of *Osmunda cinnamomea* and *O. Claytoniana* grown from the spores on nutrient solutions in the laboratory. Only

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[1] Brown, Elizabeth Dorothy Wuist. Apogamy in Osmunda cinnamomea and O. Claytoniana. Bull. Torr. Bot. Club **47**: 339-345. figs. 1-7. Aug., 1920.

one instance of apogamy in the genus Osmunda had previously been recorded and all former attempts to induce it or to detect it under natural conditions had failed.

Louise H. Coburn reports (in Rhodora **22**: 156, Sept., 1920) the apparently spontaneous occurrence of *Marsilea quadrifolia* in a pond, artificial, but fed by natural springs, in a park at Skowhegan, Maine. This is the second report for that state.

LYGODIUM JAPONICUM IN SOUTH CAROLINA.—My attention was called to this interesting climbing fern in 1913, when I saw a pot of it in a friend's garden in Summerville, South Carolina, and was told that it had been found in a near-by thicket.

While in Summerville in March, 1920, I found this fern growing on the side of a ditch, in one of the main streets of the town. The fronds, which were then quite dry and brown, were several feet long, and had twined around a small shrub. There were several small ferns, of the same kind, growing near, two of which I brought home and potted and for a year they have been growing vigorously, developing new fronds and sending up vines one of which is several feet in length.

Mr. C. A. Weatherby states that the *Lygodium japonicum* was reported as naturalized about Thomasville, Georgia, as long ago as 1905.

Mr. E. W. Graves, in a recent Fern Bulletin, mentions it as growing in Mobile along a creek and in gardens. Miss Lewis, of Summerville, has two of these ferns growing in her garden and said that she had been gathering them for a number of years in the deep ditches which drain the town. Miss Laura Bragg, Director of the Charleston, S. C., Museum, writing from there says, "I am sending you a specimen of the cultivated Lygodium which has escaped in this vicinity. It was

introduced by a florist here and there is a beautiful vine growing in the place where the greenhouses were originally."

It has been suggested that the spores of the fern may have been brought from Japan in rice. The ferns growing in Charleston were undoubtedly introduced by a florist but it seems unlikely that those growing in Summerville, thirty miles away, owe their origin to the same source.

A friend who has spent many years in Japan writes that she has found the *Lygodium japonicum* in a half dozen places around Kamahura growing generally in the long bamboo grass on the edge of a pine wood on a sandy hillside where it climbs up the grass stems or trails on the ground. The fern is not cultivated in Japan nor used ornamentally as one or two native ferns are.—MARY L. ANDERSON, LAMBERTVILLE, N. J.

American Fern Society.

Charles Noyes Forbes, Curator of Botany in the Bernice Pauahi Bishop of Museum Polynesian Ethnology and Natural History, Honolulu, died at his home in Honolulu on August 10, 1920.

Mr. Forbes was born at Boylston, Massachusetts, September 24, 1883. Following his elementary training he attended the Fay school, Southboro, Massachusetts, (1895–1897) and the High School at National City, California. In 1908 he was graduated from the University of California with the degree of Bachelor of Science. Soon after, Mr. Forbes came to the Bishop Museum as Assistant in Botany and was later appointed Curator of Botany.

During his twelve years on the staff of the Museum, Mr. Forbes developed a small miscellaneous collection

of plants into an excellent herbarium of the Hawaiian flora, a considerable part of which is the product of his skillful field work. Plans to extend Mr. Forbes' studies to Samoa and Tonga where he was to have made a botanical survey for the Bayard Dominick Expedition were unfortunately rendered impossible by his death.

In addition to his exacting routine duties as Curator, Mr. Forbes has contributed 12 articles to the Occasional Papers of the Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History. His last work is a paper on "Salient Features of Hawaiian Botany" which forms part of the Proceedings of the First Pan-Pacific Scientific Conference, held in Honolulu August 2 to 20, 1920.

A review of Mr. Forbes' work reveals an enthusiastic and courageous devotion to the cause of science, remarkable in view of his continuous poor health, and resulting in valuable contributions to the knowledge of Polynesian botany.

PUBLICATIONS OF CHARLES NOYES FORBES.

Some New Hawaiian Plants. Occasional Papers of the Bernice P. Bishop Museum—Vol. IV-No. 3. 1909.

New Hawaiian Plants II. Occas. Papers Vol. IV-No. 4. 1910.

Notes on the Naturalized Flora of the Hawaiian Islands. Occas. Papers Vol. IV-No. 5. 1911.

New Hawaiian Plants III—Plant Invasion on Lava Flows. Occas. Papers Vol. V-No. 1. 1912.

Notes on the Flora of Kahoolawe and Molokini. An Enumeration of Niihau Plants. Occas. Papers Vol. V-No. 3. 1913.

New Hawaiian Plants IV. Occas. Papers Vol. VI-No. 1. 1914.

New Hawaiian Plants V. Occas. Papers Vol. VI-No. 3. 1916.

New Hawaiian Plants VI. Occas. Papers Vol. VI-No. 4. 1917.

The Genus Lagenophora in the Hawaiian Islands. Occas. Papers Vol. VI-No. 5. 1918.

New Hawaiian Plants VII. Occas. Papers Vol. VII-No. 3. 1920.

A New Cyanea from Lanai, Hawaii, with Geo. C. Munro. Occas. Papers Vol. VII-No. 4. 1920.

Notes on Marsilea villosa Kaulf. Occas. Papers Vol. VII-No. 5. 1920.

Salient Features of Hawaiian Botany, ready for press. A paper delivered before Pan-Pacific Scientific Conference, Honolulu, T. H., August 1920.

Mrs. Emily Hitchcock Terry, a member of the American Fern Society since 1893, died in the Dickinson Hospital at Northampton, Mass., February 6, 1921, after an illness of about a year.

Mrs. Terry was the youngest daughter of President Edward Hitchcock of Amherst College, and was born in the President's house at Amherst, Massachusetts, November 9, 1837. She graduated from Mount Holyoke College in the class of 1859, and soon after married the Reverend Cassius M. Terry. After the death of Mr. Terry in Minnesota, Mrs. Terry returned to Northampton and became matron of Hubbard House, Smith College. She held this position for twenty-five years and after her retirement continued to live in Northampton the remaining eight years of her life. During all this time she exerted a strong influence in the college and community.

Mrs. Terry was an accomplished botanist and made some very interesting discoveries of plants new to New England and of new stations for rare plants. Her herbarium of flowering plants and a remarkable series of paintings of wild flowers made by her in early life were presented to Smith College. Her special interest and study however, was ferns. She early formed a friendship with Mr. George B. Davenport, and in her little fern garden in front of Hubbard House she had growing some of the rarest of American ferns which Mr. Davenport had given her. Among these were: *Aspidium spinulosum*, variety *concordianum* (Davenp.) Eastman; *Aspidium pittsfordense* Slosson, later found to be a hybrid between A. *spinulosum* (O. F. Mueller) Sw. and A. *marginale* (L.) Sw.; and *Dicksonia punctilobula*

(Michx.) Gray, forma *cristata* (Maxon) Clute. When she gave up her home at Hubbard House these ferns she passed on to the writer.

She was very fond of the Vermont country and spent many summers in Hartland, Pittsford, Bennington and Dorset. She was an intimate friend of the late Miss G. A. Woolson and Miss Margaret Slosson and with them had botanized extensively in Pittsford. Her favorite botanizing ground, however, was Dorset. Here she and Mr. Allan Bourn made many interesting finds. As a result of her botanizing in Dorset she published in the Fern Bulletin for January, 1898, a brief article on Dorset ferns. This region she regarded as one of the most prolific in the country, where in a two hours' walk she could bring home thirty-seven species and varieties. This article was supplemented by another in the July, 1905, issue of the same magazine, "More about the Ferns of Dorset." At this time she increased her original list to fifty-three species and varieties.

A few years before she died, Mrs. Terry made a collection of the ferns of Dorset. This collection was carefully mounted by her, and is now preserved in the village library in Dorset where it will be available to all.—H. G. RUGG.

Miss Nellie Mirick, in a recent letter to the Treasurer, makes mention of the fact that she has been a member of the Society twenty-five years. This has led to a census of the members who joined during the first three years of the Society's life and are still on our rolls. There are eleven in all. First come the three charter members, Prof. Clute, the founder, Prof. Petty, and Dr. Waters. Miss Elmira Elsie Noyes joined in 1893, but not as a charter member. After her come Miss Dora Radlo, 1894; our President and Miss Harriet Wheeler, 1895; and, besides Miss Mirick, Mrs. M. A. Noble, Charles O. Rhodes and D. Leroy Topping in 1896. We

wish to congratulate them all; and, still more heartily, to congratulate the Society on their continued interest and service in it.

In connection with the Fern Exhibit of the Mass. Horticultural Society there was called a meeting of the members of the American Fern Society, living in and near Boston. About twenty members were present, with Mr. Wm. R. Maxon, President, in the chair. Mr. Maxon was president in connection with the Fern Exhibit for which he had been asked to serve as one of the judges. Dr. Benedict was in charge of the exhibit sent by the Brooklyn Botanic Garden; he also delivered an illustrated lecture on ferns and prepared a pamphlet on cultivated ferns which was distributed by the Horticultural Society to persons attending the exhibit. Miss Marshall and the other two editors were also present, so that the officers were pretty well represented.

The meeting included a discussion of various items connected with the increase in membership,—the Society has now for the first time, reached the mark of three hundred members and is still growing. Mrs. Scott suggested that members locally might well endeavor to interest their park authorities in establishing plantations of local hardy ferns, both for their beauty and to educate the public to a better knowledge of these plants.

The question of enlarging the scope of the American Fern Journal by endeavoring to secure more articles on various greenhouse ferns, especially those which are valuable as house plants, was discussed. It was pointed out that, even if we were disposed to interpret with entire strictness the statement on our stationery that the Society is devoted particularly to the study of native ferns, the tropical ferns of Porto Rico, Panama and the Philippines might now be said to be natives of the United States.

Quite aside from this, Mr. Maxon called the attention of the members to a series of herbarium specimens of beautiful tropical ferns not now in cultivation, and which possess elements of marked beauty, surpassing many of those now in the trade. Species of Anemia, Elaphoglossum, Polybotrya, a miniature tree fern from Cuba of perfect proportion, but like an umbrella in size, were among the specimens shown. It is Mr. Maxon's hope that on some of his future trips to the tropics he may be able to make arrangement for the introduction of some of these plants.

Following the informal meeting, the members met informally for supper.

The Judge of Elections reports the re-election of the present officers by a vote of 85 to 0 in each case.

Mr. Nathaniel T. Kidder, Milton, Mass., would be glad to hear from anyone who has for sale any of the first 12 numbers of the *Fern Bulletin* except no. 9, and Vol. 4, except no. 2.

Mr. W. R. McColl, Owen Sound, Ontario, has the following ferns for exchange: *Aspidium Boottii, Clintonianum, marginale, Filix-mas, Filix-mas* × *marginale, Goldianum, spinulosum* × *marginale, Thelypteris. Asplenium angustifolium, viride. Athyrium Filix-femina, thelypteroides. Camptosorus rhizophyllus. Cystopteris bulbifera* (freak forms), *fragilis. Phegopteris Dryopteris, Robertiana. Polypodium vulgare. Polystichum acrostichoides, Lonchitis, munitum. Scolopendrium vulgare.* Ferns of the West, the South, or the tropics preferred in return.

American Fern Journal

Vol. 11 OCTOBER–DECEMBER 1921 No. 4.

The Boston Fern Show

R. C. BENEDICT.

The Boston fern show deserves to be reported first from the standpoint of the fern lover, as are all members of the American Fern Society. It should be reported also as indicative of the present status of tropical ferns as cultivated plants in the United States. Finally there should be reported as accurately as possible a list of the different kinds of ferns which were shown at Boston since the exhibition probably included most of the species and varieties at present cultivated in this country.

The desire of every fern lover is to find for himself some new or hitherto unfamiliar kind of fern, or to find some old friend in an unexpected place. He delights also in discovering some glen, woods, cliffside, or ravine in which masses of ferns luxuriate, in which perhaps a considerable number of different kinds occur together.

Mr. E. J. Winslow claims for the Willoughby Lake region, Vermont, precedence in the number of fern species native in a limited area, at least in the more northern states. The central New Yorker notes the claim, but thinks with complacency of his limestone slopes and cliffs, his glacial period "fossil" water falls, with their wealth of ferns, especially their prized hart's tongue. Dr. John K. Small rhapsodizes of Florida, - the "Land of Ferns" he calls it, -and writes book after book to make its fern wealth better known.

[Vol. 11, No 3 of the JOURNAL, pages 65-96, was issued Feb. 3, 1922]

Boston from Sept. 22-25 reproduced a "land of ferns" through the activity of the Massachusetts Horticultural Society, and its president, A. C. Burrage. On the days and nights preceding Sept. 22nd, trains, boats, and auto trucks were carrying ferns in quantity toward Horticultural Hall, the home building of the Horticultural Society. To this focus there were gathered from Pennsylvania, New Jersey, New York, Connecticut, and Massachusetts, from commercial growers, from private individuals, and from public institutions, more species of ferns than are found in any state in the Union, even Florida, almost as many as are to be found in the whole country. The Brooklyn Botanic Garden sent sixteen large cases and crates, totalling nearly two tons, but W. A. Manda, a commercial grower of South Orange, N. J., sent one hundred and twenty-five, weighing proportionately more. One o'clock, Thursday, Sept. 22nd, after all night labor by many, found the exhibition ready for visitors.

The visitor entered first a room about sixty-five feet long, given over entirely to the plants entered by Mr. Burrage. The center was a bower of splendid tree ferns, mostly Mexican cibotiums set high on cork covered pedestals. The four walls were hidden by arrays of ferns and orchids, with some other plants. On one wall were numerous plants of the bizarre staghorn ferns, Alcicornium, (or Platycerium.) stretching out their spore bearing antler-like leaves while their humus leaves clung tightly to the substratum. At the other end of the room, through a lane of tree ferns, was an array of various foliage plants, Begonias, selaginellas, and hanging baskets of a Polynesian polypodium, *P. subauriculatum*, and its ruffled variety, *Knightae*. Against the long wall at the left was a glorious spread of orchids, mostly of the Cattleya type, but with all manner of colors, intermingled with sprays of Oncidium, with its

panicles of yellow butterfly flowers, and with ferns for background.

The remaining wall held the greatest interest for the fern lover. Picture a rocky slope sixty feet long, perhaps ten feet on the slope, with bays and projecting promontories, covered with a diverse array of tropical fern species, scarcely two plants of the same species, and with a total of nearly one hundred kinds altogether. It was not merely a pot plant display, for the plants were set among the rocks, with the pots hidden under moss or otherwise concealed, and the different kinds stood out as individuals growing naturally against a not improbable background. The feeling of the wild was somewhat interrupted by a grotto or cave in the center, with white figures of children, electrically illuminated.

It is difficult to pick out any particular species for special comment. The whole bank was a wealth of forms, representing about forty genera. Perhaps *Selaginella uncinata* (or *caesia*), in a collection of selaginellas, deserves comment for its beautifully iridescent, blue-green foliage, most unusual in plants. Credit for the general arrangement of this room goes to Mr. Douglas Eccleston, superintendent for Mr. Burrage.

In the next room there were a series of glass cases containing leaves of various fern species displayed to show their fruiting characteristics, and one case with fern books. This room was in a balcony, overlooking the main hall, over one hundred feet long, and two or three stories high.

From it one looked down on tons of ferns, covering hundreds of square feet of floor and wall space under their varying shades of green. In the foreground, the Manda collections were most attractively arranged in a landscaped effect, with a central plot of "lawn," made by a spread of a small variety of Boston fern, sloping

sideways and toward the back to higher plants, interrupted by occasional taller plants, and with tree ferns rising along the sides. Bunker Hill monument, done in selaginellas, stood at the front and foot of the hill instead of at the top. Hanging baskets of polypodiums, fern balls of nephrolepis, maidenhairs, flanked the wall at the left, while a cluster of huge cibotiums, a "herd" of staghorns, and a corner of bromeliads covered the other wall.

Beyond the main Manda group were smaller groups, of orchids, of cacti, and some other flowering plants, as well as of ferns. The champion fern of the whole exhibit was a huge *Angiopteris erecta*, shown by Julius Roehrs, of Rutherford, N. J. Its leaves towered ten feet from a fleshy stem, with leafstalks three inches through. One of the most beautiful species in the whole exhibition was shown by Thos. Proctor, in *Davallia Mooreana*, with beautifully cut pale green leaves. The far end of the large room was covered with cedars, to top a banked display of ferns shown by Wollrath & Sons of Massachusetts.

In the third room were two fern groups, together with several orchid collections of special merit, including the champion orchid of the entire exhibition. Here were fifty plants of Boston fern varieties shown by F. R. Pierson, of Tarrytown, N. Y., who grows specimen plants so full of leaves as to make one wonder how they can all be nourished from one pot of soil. Here also were the ferns sent by the Brooklyn Botanic Garden, one hundred and eight species and varieties. Sixty-six belonged in one genus, *Nephrolepis*, and forty-seven were varieties of one form, the Boston fern, the genealogy of which had been worked out at the Garden. The other ferns included forty-two different forms covering as wide a range of genera and families as possible, and including such oddities as the mosquito fern, *Azolla*,

the floating fern, *Salvinia*, the four-leaved clover ferns, *Marsilia quadrifolia* and *M. Drummondii*, and the horn fern, *Ceratopteris pteridoides*, found in Florida, floating on streams. Here also were the non-fern types, *Isoetes*, *Selaginella*, *Psilotum*, an epiphytic lycopod type of the tropics, and *Equisetum scirpoides* as a vigorous pot plant.

We may hope that this, probably the first horticultural exhibition mainly devoted to ferns to be held in this country, may be regularly and widely repeated. Certainly the members of the American Fern Society do not require any arguments to convince them that these, their favorite plants, are worthy of such recognition.

LIST OF FERN SPECIES EXHIBITED.

In the list which follows, undoubtedly some few species have been unintentionally left out. It makes no real attempt at scientific accuracy of nomenclature, but is aimed rather at listing under some approximately correct name, all the ferns exhibited, and it is hoped that it may serve as a basis for a more accurate and complete list of horticultural fern species in general. As it stands, it probably includes nearly all the ferns which may be considered commercial forms. Some additions, of course, must be made. Not all the current forms of Pteris and Nephrolepis are shown, and some other types must probably be added, but with these possibilities, the present list is offered as preliminary to the drawing up of possibly a standardized generally accepted set of names.

In conclusion, it may be added that Mr. Wm. R. Maxon, of the Smithsonian Institution, Washington, will be glad to receive herbarium specimens of various cultivated ferns, and to give identifications when desired. At the Brooklyn Botanic Garden, I shall be glad to receive living specimens of cultivated ferns, and to identify as far as possible varieties of Boston fern

and other horticultural forms. Any information which will aid in correcting, or adding to the attached list, especially if accompanied by specimens, will be welcome.

ALPHABETICAL LIST OF GENERA AND SPECIES.

Adiantum Bausei
Charlottae
Croweanum
cuneatum
diaphanum
Farleyense
formosum
gracillimum
gloriosum
hybridum
Lemkesi
multiceps
O'Brieni
reginae
rhodophyllum
tenerum
trapeziforme

Alcicornium alcicorne
angolense
biforme
ethiopicum
grande
Hillii
Hillii majus
majus
Stemmaria
Veitchii
Willinckii

Alsophila australis
dealbata
Mandiana
robusta

Anapausia aliena
flagellifera

Angiopteris evecta

Asplenium flaccidum
longissimum
nidus
rigidum
viviparum

Azolla caroliniana

Blechnum brasiliense
brasiliense undulatum
gibbum
occidentale

Callipteris esculenta

Campyloneuron decurrens
phyllitidis

Ceratopteris pteridoides

Ceropteris tartarea

Cibotium glaucum
lucidum
Mandianum
princeps
regale
Schiedei

Coniogramme japonicum nigrum

Cyathea medullaris

Cyclophorus lingua
lingua corymbifera
numularioifolius

Cyrtomium caryotideum
falcatum
falcatum Davidianum
falcatum Rochfordianum
falc. Rochf. compactum

Davallia bullata

Davallia
elegans
fijiensis
fijiensis plumosa
lucida
pentaphylla
Mooreana

Dennstaedtia adiantoides
cicutaria

Dicksonia antarctica

Didymochlaena lunulata

Diplazium lanceum
zeylanicum

Doodia aspera
lunulata

Doryopteris elegans

Dryopteris filix-mas lepida
filix-mas Richardsii multifida
lepidocaulon
setigera
viridescens

Elaphoglossum guatemalense
latifolium
muscosum
stelligerum

Equisetum scirpoides

Gymnogramme (Ceropteris)

Humata membranacea

Hymenodium crinitum

Isoetes, species

Lygodium japonicum

Marsilea Drummondii
quadrifolia

Meniscium, species

Microlepia marginalis

Nephrolepis acuminata
acuta
Barteri
biserrata
biserrata furcans
cordifolia
cordifolia compacta
cordifolia gigantea
cordifolia tessellata
Duffii
exaltata
exaltata bostoniensis
exalt. bost. Alberti
Amerpohli
Anna Foster
Craigi
densa
dissecta
edmontoniensis
elegantissima
elegantissima compacta
Elmsfordii
"Emerald fleece"
falcata
fertilis
Galvestoni
Giatrasi
Gretnai
Hillii
Macawii
magnifica
Marshallii
Milleri
Millsii
muscosa
Norwoodi
Piersoni

Nephrolepis exalt. bost.
plumosa
plumosa aurea
Randolphii
Rochfordii
robusta
Rooseveltii
Schubertii
Scholzelii
Scottii
Smithii
superbissima
superior
splendida
"Teddy Jr."
todeoides
todeoides compacta
"trailing"
verona
victoria
viridissima
Wagneri
Wanamakeri
Whitmani
Whitmani compacta
floccigera
hirsutula
Mayii
Mayii cristata
pectinata
recurvata
rivularis
superba
Westoni
zollingeriana

Onychium japonicum

Pellaea falcata
viridis

Pessopteris crassifolia

Platycerium (Alcicornium)

Polybotrya osmundacea

Polypodium aureum
aureum Mandianum
aureum Lowii
fraxinifolium
glauco-pruinatum
heracleum
incanum
Meyenianum
neriifolium
pectinatum
percussum
piloselloides
punctatum
pustulatum
sphaeridocarpon
subauriculatum
subauriculatum Knightae
vacciniaefolium

Polystichum adiantifolium (coriaceum)
amabile
aristatum
lobatum
setosum
tsus-simense
variegatum (aristatum)
varium

Psilotum triquetrum

Pteris altissima
cretica
albo-lineata
Alexandrae
rivertoniana
Wilsoni
ensiformis Victoriae
juglandifolia
longifolia
Parkeri
podophylla
quadriaurita argyraea
serrulata
serrulata cristata
tremula
Wallichii

Salvinia natans

Selaginella africana
amoena
Brownii
caesia (uncinata)
caulescens
denticulata
emiliana
emiliana aurea
haematodes
Kraussiana
Mandiana
Martensii
Martensii variegata
patula
Pitcheriana
serpens
viticulosa
Wildenovii

Selliguea caudiformis
elliptica

Stenochlaena tenuifolia

Tectaria cicutaria
heracleifolia

Vittaria lineata

Woodwardia orientalis

By way of summarizing, it may be noted that the total number of forms listed is 248; that of these W. A. Manda showed one hundred and forty-eight different kinds; A. C. Burrage one hundred fifteen; the Brooklyn Botanic Garden one hundred and eight. In the total list, fifty-four genera out of the total one hundred fifty fern genera known, were represented. Mr. Burrage's collection included forty different genera.

BROOKLYN BOTANIC GARDEN

Notes on American Ferns—XVIII[1]

WILLIAM R. MAXON.

ASPLENIUM PALMERI Maxon. This species, which is common in Mexico, has heretofore been known in the United States only from specimens collected in the Mule Mountains, Cochise County, Arizona, August, 1911, by Leslie N. Goodding (no. 976). It may now be reported from the Organ Mountains, New Mexico, upon material collected by E. O. Wooton, March 3, 1907. The specimen referred to is in the Dudley Herbarium of Stanford University, mounted with plants of *A. resiliens* Kunze, these apparently collected at the same time and place.

[1]Published by permission of the Secretary of the Smithsonian Institution.

Notes on *A. palmeri* were published in this Journal[2] a few years ago.

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott. In this Journal there was described[3] in 1913 a fern from the vicinity of Great Falls, Virginia (a few miles above Washington, D. C.), which was regarded by the describer Mr. F. C. Greene, as a hybrid between *Polystichum acrostichoides* and *Dryopteris cristata*. The plants "were found in company with a great number of typical *P. acrostichoides*, and with several plants of *D. cristata* growing a few feet distant." Since the figures accompanying the description seemed to represent a plant differing in no important respect from some of the forms with incised or pinnatifid pinnae that *P. acrostichoides* often assumes, the writer expressed a desire to examine a portion of the material. To this request Mr. Greene very obligingly responded by presenting two typical fronds, a fertile and a sterile, to the National Herbarium. These entirely confirm the view that the plant in question is only an extreme condition of *P. acrostichoides*. There are no indications of *D. cristata* as a possible parent, nor were any definitely stated in the original description. Unfortunately the hybrid is listed as valid in the second supplement of Christensen's Index Filicum.

POLYSTICHUM ANDERSONI Hopkins. An interesting extension of range for this species, previously known from British Columbia, Washington, and Montana, is noted in a specimen from Tracy Arm, Sumdum Bay, southeastern Alaska, collected August 17, 1921, by William S. Cooper (no. 50). The specimen, though consisting of a single poor frond, is unmistakably of this species rather than *P. alaskense* Maxon.[4] Tracy Arm is a short distance southeast of Juneau.

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[2] **3: 109. 1913.**

[3] **Amer. Fern Journ. 3: 83–85, figs. 1–7. 1913.**

[4] Amer. Fern Journ. **8**: 35. 1918. See also, Amer. Fern Journ. **10**: 2, 3. 1920.

EQUISETUM PALUSTRE L. Several years ago the writer reported this species from the Wenaha National Forest, northeastern Oregon (*Laurence* 95), a new record for the state.[5] A wide extension of range is indicated by recent specimens from Marion County, Oregon. These were collected by Prof. J. C. Nelson in a wet meadow in bottom land near the Williamette River, 3 miles northwest of Waconda, May 13, 1921 (*Nelson* 3605) and in a grain field 3 miles north of Chemawa, May 28, 1921 (*Nelson* 3705). According to Professor Nelson's notes the plant is abundant in the low ground north of Chemawa, but is rarely found in a fruiting condition.

SELAGINELLA ASPRELLA Maxon. This species, described[6] from specimens collected on Ontario Peak, San Antonio Mountains, southern California, by Ivan T. Johnston (no. 1815), and known from two other collections in the same range (*Johnston* 1595, 1807) has more recently been gathered in the neighboring San Bernardino Mountains by Mr. C. F. Saunders. Mr. Saunders' plants were collected September 14, 1921, on the side of Snow Canyon, at an elevation of 1,800 meters, from the chinks and base of rocks in sunny situations. It was locally abundant, matting the rocks where it grew. Snow Canyon is otherwise of interest as being the only known California station for *Dryopteris filix-mas*.

WASHINGTON, D. C.

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[5] Amer. Fern Journ. **7**: 106. 1917.
[6] Smiths. Misc. Coll. **72**[5]: 6. pl. 4. 1920.

Plant Sanctuaries.

ELIZABETH G. BRITTON.

Since the Audubon Society began founding its *Bird Sanctuaries* there has been an increasing sentiment among those interested in the conservation of wild life to do the same for plants. The Ecological Society of America has attempted to get together all the information available concerning native plants needing protection and the localities where they are still abundant in their natural conditions. This information has not yet been made public, but in a brief report published in *Science* on May 6th, 1921, the statement is made that even in our National Parks no special effort is being made to mantain them as natural areas and that science has left the general public, who look upon them mainly as recreation parks, quite uninformed as to the advantages of *biological* studies in these National Parks. Some of the members of the American Association of Park Superintendents have also been interested in the preservation of our native plants in places where it is possible and are advocating their planting as food and shelter for birds and animals. The various Garden Clubs of the United States are also advocating the planting and cultivating of many of our native plants and creating a demand among dealers for seeds and roots.

The ferns are sharing in the general interest and some of them have become commercialized and are becoming rare or extinct in consequence. Probably the most dangerous enemy of the ferns is fire. Next to fire, transplanting into unsuitable localities where they promptly die, causes the destruction of many. Automobile parties come in from the country laden with cinnamon and other ferns, plant them in sunny dry places and repeat the experiment with other ferns, indefinitely. The use of native ferns for table decoration

should also be discouraged; perhaps the least harmful is the gathering of "*lace-ferns*" to supply the florists, for in this case the roots are not disturbed and the plant has a chance to grow another year. We have grown, very successfully, a colony of the Ostrich Fern on the shady side of the house, where it has multiplied and spread by long root-stocks.

WILD FLOWER PRESERVATION SOCIETY OF AMERICA,
NEW YORK BOTANICAL GARDEN.

The Climbing Fern in the Vicinity of Hartford.

C. A. WEATHERBY.

This story is in the nature of an obituary. After having survived fire and all the natural dangers to which a plant is exposed and the further perils incident to being a favorite of fashion, the climbing fern, once the chief feature, fern-wise, of this region and so remarkably common here, for it, that one of its names is the "Hartford fern," seems now doomed to early extinction through the clearing of its habitat for agricultural purposes.

There are several reasons why the climbing fern is of especial interest. The first is, that it, alone among the native ferns of the United States, does climb. Its slender, but tough, brown stems, twining over the bushes, and its rather pale green leaves, shaped somewhat like a hand with the fingers out-spread, give it a wholly unique appearance. It is the last of our northeastern ferns to begin growth in the spring and to come to maturity. The accompanying photograph was taken well into the summer, yet the summit of the stem is not yet fully uncoiled. The graceful fruiting panicles which appear above the leaves in late summer, are not ripe till the end of September. The climbing fern and its queer relative, the curly grass, are the only representatives of their family, the *Schizaeaceae*, native in

The Climbing Fern, Lygodium palmatum, near Hartford, Conn.
From a photograph by R. C. Benedict

the United States. And, finally, the climbing fern is one of the rarer species of the world. Its range, "southern New Hampshire to Florida, Tennessee and Kentucky" is not large, as the ranges of species go, and within this territory it occurs in abundance only at scattered and often widely separated localities. The number of individuals in existence must be insignificant compared, for instance, with the number of royal or cinnamon ferns. In all these respects, then, it occupies a place of distinction.

It may be doubted whether Lygodium was very common about Hartford when the first settlers came. As we know it now, it is a plant very particular as to the place in which it grows. It will not endure too much water, or too little, too deep shade, or none at all; and here, at least, it insists on a sandy soil. Its favorite haunts are bushy hollows in the sand plains where the soil is covered with three or four inches of moist black leaf-mold in which its slender rootstocks lie. Such habitats must have been rare under primitive conditions when this region was pretty completely covered with dense forests, largely of white pine. They must have been confined to the borders of the bogs and sloughs occasionally found in the sand-plains. There, with the light which came in from the open spaces of the sloughs, the moisture of their banks, and with the aid of its climbing habit which would enable it to make head among the shrubs which likewise seek such situations, Lygodium could, and doubtless did, flourish. As the settlements grew, suitable habitats were unconsciously provided for it in pastures and along the edges of fields and roads; to them it spread and there it multiplied until, though always local, it became one of the familiar and well-known plants of the countryside.

At some time in the sixties, some one discerned in

it decorative possibilities. That was a time of rather rococo taste, of "tidies" and "what-nots" and redundant bric-a-brac: perhaps it is rather to its credit that it recognized the grace and beauty of this little plant. But it was not good for the plant. It became all the rage for house decoration. People who could went out in the fall and gathered their own supply of it: others bought theirs from peddlers who picked the fronds almost by the wagon-load. and sold them on the streets of Hartford. They were bought fresh, then pressed or ironed, with the iron not too hot. So treated, and being naturally evergreen. they would stay green and fresh-looking all winter. No house was considered complete and up-to-date without at least a few sprays draped along the cords and over the frames of pictures and mirrors. Some, at least. of the fern must have been exported: Mrs. Parsons tells of seeing her parents' house in New York decorated with fronds brought from Hartford for the purpose.

Perhaps in the literature of the time some one has written down the detailed history of this fashion. If so, I do not know it, and definite information about it—how long it lasted. how much damage it caused—is now hard to get. Certainly, however, large quantities of the fern must have been used, and the people living in the region where it grew became disturbed and applied to the legislature for relief. That body responded, and on July 8, 1867. the first bill for the protection of a wild plant passed anywhere in the United States, forbidding anyone "wilfully to sever or take from the land of another any Lygodium or creeping fern growing or being thereon," became a law. How far this action had its beginnings in the natural exasperation of farmers whose pastures and wood-lots were invaded by fern peddlers. cannot now be determined; but it is interesting to note that the main argument of

the representative in charge of the bill was based on the rarity of the plant and the destruction of it being wrought. Conservation of wild life, then, was at least one of the real objects of the law; and the legislature was sufficiently in earnest to provide a jail penalty as well as a fine for infractions of it.

How strictly the law was enforced and whether any convictions were actually obtained under it, I do not know. But it must have provided the owners of land on which the fern grew with a better weapon than the general trespass laws could offer; and it doubtless hastened the death of the fashion. Certainly the fern, to a considerable extent, came back. Ten years ago it was still possible to see great tangles of it beside the main road from East Windsor Hill to Wapping; and I have watched a new colony appear and establish itself in a clearing. But what fashion failed to do, tillage is doing. The principal crop hereabouts is tobacco, and tobacco flourishes best in the kind of soil which Lygodium prefers. Moreover, though a laborious and somewhat risky crop to raise, it brings in a good profit when successful and more and more land is being devoted to it each year. So it happens that there is no more climbing fern on the Wapping road; and the axe and the plough draw nearer each season to the one large station still known to the writer in the South Windsor sand-plains. This cannot be prevented: we cannot, and ought not to, stop the clearing of land suitable for tillage. Lygodium may continue to eke out a precarious existence in nooks and corners for many years to come: but only by setting aside as a sanctuary some area small enough not to be missed by the farmer, where it can grow undisturbed, can its continued existence in any quantity be assured.

EAST HARTFORD, CONN.

Is Botrychum dissectum a Sterile Mutant?

In answer to this query, first put by Prof. Chamberlain in the Botanical Gazette, and passed on by the JOURNAL to its readers, the following have been received.

In regard to *Botrychium dissectum*, I wish to call your attention to a find I made this September in Cass Co., Indiana, in a sandy black-white oak wood. I found a field of about three acres that had been cleared in the center of a large wood. This wood was until recently an Indian reservation. The cleared field was an old camping ground with a spring near the center. About the low place were elevated places which you might call hills, say about fifteen to twenty feet in height. The soil is very sandy. On the south side of the cleared field or opening and within fifty feet of the woods on the south side of the field and somewhat in the shade of a few small trees that have grown up, I found a single *B. obliquum*. I searched for more but could not find any. But there were literally hundreds of *B. dissectum* of all sizes. The associates were *Lechea villosa*, *Lechea* sp. *Potentilla canadensis*, *Spiranthes cernua*, *Sabatia angularis*, *Helianthemum*, *Agrimonia parviflora*, *Ceanothus*, *Viola* sp., *Poa* sp., *Panicum* sp., *Syntherisma* sp. and others. The Botrychium was growing commonly in a moss I took to be a species of **Polytrichum or something like it.** . . . .

I might say this is the first instance where I have found either *B. obliquum* or *dissectum* as common. I have never seen *B. dissectum* before except as an occasional plant. The same with *B. obliquum*, except in flat woods in the southern part of the state where it sometimes is found in goodly numbers.—C. C. DEAM, BLUFFTON, IND.

The above question, propounded and partially answered in a recent number of the Journal, will in all

probability be answered in various ways by different persons, depending upon the writer's idea as to what constitutes a valid species and what a mutant really is.

To the writer *B. dissectum* has never seemed to be a valid species but merely a variation in the depth of the marginal serrations of the ordinary *B. obliquum*. To see typical specimens of each in the herbarium is one thing and to see in the field, as any one who cares to do so may see, typical specimens of each species and a perfect series grading either way almost insensibly from one to the other, all growing within a few feet of each other, is another, giving an entirely different impression as to the validity of the species.

Before the relative numbers of the two species in any given area can be accurately determined, a definite agreement must be had as to just how far the cutting of the leaves must go before the plant is placed in the dissectum group. Until this is done different observers will give widely divergent answers as to the relative numbers of each species in the same colony or given area under observation.

To the writer it rather seems that person who made the observations in Ohio cited in the JOURNAL must have selected colonies suited to the particular purpose in mind and if this was not done the observer should have looked a little farther for there are many places where the ratio of the two species to each other is entirely different from that quoted, as the dissectum is many times more numerous, relatively speaking, than the citations would have us believe.

On Dec. 10 a small colony of plants was counted which showed 15 plants of the obliquum type to 13 of dissectum. These plants are to be found on a brier covered sandy knoll facing the west in an old orchard within the city limits of Kent. The colony does not extend over a space of more than 20 x 30 feet.

A smaller colony not over a mile away growing under about the same ecological conditions showed 10 obliquum to 7 dissectum in a space about 8 x 10 feet.

In each case all plants that were not typical obliquum were regarded as belonging to the dissectum group. Another observer taking a different view-point might arrive at an entirely different result after counting the same colonies of plants. We shall get nowhere in the matter of determining the frequency of occurrence of the two species until some definite standard of classification is adopted.

If dissectum is a valid species, will some one please tell us just how deep the laciniations must be to make it so? If it is a "sterile mutant" which is cause and which result— is it a mutant because it is sterile or sterile because it is a mutant and just what degree of sterility must a plant possess and what degree of laciniation must it have to become a mutant?—L. S. HOPKINS, KENT, O.

SOME FERNS SEEN IN CALIFORNIA—On July 3rd and 4th Mr. Robert Kessler and the writer went for a hike into the back part of the San Gabriel Range. Starting from Switzer's Camp, in the Arroyo Seco we went, via Barley Flats to Pine Flats, returning by way of the Trail Fork and West Fork of the San Gabriel River, around San Gabriel Peak, Mt. Markham and Mt. Lowe, to Alpine Tavern, on Mt. Lowe, where we took the trolley for Los Angeles. We did not collect many ferns but noted the following.

Filix fragilis (L.) Gilib. In a springy place in the south wall of Tejunga Canyon.

Polystichum munitum (Kaulf.) Presl. Frequent above 900 m. elevation. A single plant strongly resembling the var. *inciso-serratum* D. C. Eaton, except in that it

was little, if any, larger than the typical form, was found in the upper Arroyo Seco.

Thelypteris arguta (Kaulf.) Moxley. Common throughout the chaparral belt on shaded and rocky slopes, mostly below 900 m.

Woodwardia Chamissoi Brack. Frequent in all the canyons in wet, shady places below 1200 m.

Adiantum Capillus-veneris L. Occasional on shaded dripping cliffs in the lower Arroyo Seco.

Pteridium aquilinum pubescens Underw. A low form of this was common on Pine Flats, at an elevation of about 1650 m. It has been somewhat interesting to note that this plant is quite dwarfed at high elevations. Whereas below 300 m. it is frequently as much as two meters high, at this station it is hardly more than six dm.

Pellaea andromedaefolia Fée. Common on rocky hillsides.

P. mucronata D. C. Eaton. Common on dry hillsides.

Cheilanthes Covillei Maxon. Frequent in shaded clefts of the rocks. We were surprised to find this at a much lower elevation than usual, in the Trail Fork of the San Gabriel.

Cheilanthes californica (Nutt.) Mett. Common in shady places in the chaparral zone.

Polypodium californicum Kaulf. Common on shaded rocky banks.

Two or more species of *Equisetum* were noticed, but we did not collect them nor try to determine their identity.

Selaginella Bigelovii Underw. Common among rocks and on dry slopes.—GEORGE L. MOXLEY, LOS ANGELES, CALIF.

OPHIOGLOSSUM VULGATUM IN BUCKS AND MONTGOMERY COUNTIES, PA.—I never forget the time when I first found *Ophioglossum vulgatum*. It was one of those pleasant occasions when one finds what he has not been

looking for. These finds I always consider the best one can make.

It was on July fourth, 1916, while out on a botanizing trip, that I passed through some moist, shaded woods near Finland, Bucks Co. Between two large rocks I first found this pretty little plant. It was such a pleasant surprise that I at first thought it could not be possible. I hesitated for a while before I touched a plant. I counted them before I dug any up; there were just seventy-five on a circular piece of ground about three feet in diameter. Not only did I find them in this spot, but over the whole of this five acre piece of woodland. Since then I have been visiting the place every year and always find a good supply waiting to welcome my coming.

I have been told that Mr. Witmer Stone, Curator at the Academy of Natural Sciences of Philadelphia, while on a trip to Finland two years ago, was passing through a meadow about a mile from my patch of woods and, picking up a handful of grass, he found that he had also unknowingly picked a few plants of Ophioglossum. So you need not fear disappointment if you go to Finland for this plant, as it seems to be growing in almost any moist meadow or woodland there.

In July, 1919, while on a trip with Rev. Brendle of Greenlane and Dr. Kline of Collegeville, Pa., we passed through a wet meadow about one mile south of Zieglersville in Montgomery Co. Our trip was for nothing in particular, only for what we could find. Here Mr. Brendle made his hit for the day—he found his first plant of Ophioglossum. This made him feel so glad he almost forgot that the next day was Sunday. A further search proved that the plant is growing over the whole of this meadow, about five acres.

The greatest find of this fern was made in the same year by Mr. Brendle and myself while on a botanizing trip in the great meadows east of Sumneytown, Montgomery Co. These wet meadows are on an average

about one half mile wide and about three miles long. They extend for about two miles along Ridge Valley Creek in Montgomery Co., then turn in a more northeasterly direction and away from the creek, extending for about one mile into Bucks Co. Here they are bordered on both sides by steep wooded hillsides, with the Unami Creek just across the hill to the west and the Ridge Valley Creek to the east. Here, in these great meadows the Ophioglossum grows in great abundance, especially on the Bucks Co. side (the county line crossing the meadows about 200 ft. below the middle). Roughly speaking, I believe I can honestly say that this fern grows here by the thousand, so thickly at some places that you cannot take a step without getting some of it under the sole of your shoe.

Besides the Ophioglossum, these meadows present a very interesting flora to the visitor. *Pogonia ophioglossoides* seems to be one of the most common species. Through the upper half of the meadow this orchid grows in very great abundance, and is a beautiful sight when in bloom. It is a large statement, but I fully believe that if one would go to the trouble, one could count a million plants of this orchid growing there.

Drosera rotundifolia is also very abundant, and so is *Scleria pauciflora*. The typical form of *Arisaema pusillum* and an albino variety grow here. Other interesting plants are:—*Melanthium virginicum*, *M. latifolium*, *Liparis liliifolia*, *L. Loeselii*, *Spiranthes gracilis*, *S. cernua*, *S. vernalis*, *Cypripedium pubescens*, *C. acaule*, *Habenaria flava*, *H. clavellata*, *H. psycodes*, *Orchis spectabilis*, *Corallorrhiza maculata*, *C. odontorhiza*, *Batrachium trichophyllum*, and eighteen different varieties of ferns.

Just two miles away from my home town is one of the few stations where grows the rare *Corallorrhiza Wisteriana* (Wister's Coral-root). I have several good

dried specimens of this plant which I shall be glad to give to any member of the American Fern Society who asks for them. I have also specimens of Ophioglossum which any member of the society is welcome to for the asking, green or dried.—JOSEPH R. MUMBAUER, PENNSBURG, PA.

ANOTHER RICH FERN LOCALITY—Last summer my work took me to North Adams, Mass., where my first walk revealed more than a dozen species of ferns and where all of my spare time for over four months was devoted to the woods and fields.

Within a mile and a half of North Adams is a pasture on a rocky hillside with rocks sticking up 10-15 feet or more. On one of these rocks and immediately below it, near a small spring shaded by four or five trees, in an area less than fifty by a hundred yards, I found a remarkable variety of ferns, in all fourteen different species. They were: *Adiantum pedatum*, *Asplenium ebeneum*, *A. thelypteroides*, *A. Trichomanes*, *Athyrium Filix-foemina*, *Cystopteris bulbifera*, *Nephrodium Goldieanum*, *N. marginale* *N. noveboracense*, *N. spinulosum*, *Onoclea sensibilis*, *Phegopteris polypodioides*, *Polypodium vulgare*, ***Polystichum acrostichoides.***

Near by, in fields and woods, were besides: *Camptosorus rhizophyllus*, *Cystopteris fragilis*, *Dicksonia pilosiuscula*, *Nephrodium Boottii*, *N. cristatum*, *N. Thelypteris*, *Osmunda cinnamomea*, *O. Claytoniana*, *O. regalis*, *Phegopteris Dryopteris*, *Pteris aquilina*, ***Struthiopteris germanica, Woodsia obtusa.***

At least two species of the spinulose wood fern group can be found and a fern which I did not recognize at the time I found it evidently is *Nephrodium simulatum*. The hybrid, *Nephrodium cristatum* × *marginale*, grows near the entrance to the Hoosac Tunnel and at least two of the Botrychiums are quite common. Until late summer I was unable to find more than the half dozen

somewhat crippled plants of Goldie's shield fern stationed near the little spring; but one Sunday in October, while crossing the country on my way from Mt. Greylock to North Adams, I saw this large, beautiful fern growing by the hundreds in company with silvery spleenworts and almost covering the ground for quite a distance.

Although the walking fern and the ebony spleenwort grow almost side by side, I never saw the hybrid. *Asplenium ebenoides*. Neither did I find *Asplenium Ruta-muraria* till I crossed the Vermont state line. A visit to North Pownal yielded that pretty little fern and *Pellaea atropurpurea*. It seems to me that if someone were to transplant a few of these rare ferns to the North Adams region they ought to grow as well on ragged lime rocks as they do a few miles farther north.

Not counting the ferns found at North Pownal, this list includes 31 or 32 species, 29 of which grow on the same hillside and within a radius of a quarter of a mile. This number I found; but I am only a beginner, with limited time, and by no means any expert. I believe someone else with more experience and plenty of time could do considerably better and probably find a record number of species. If anybody wants to go there to check my list and look for more, I shall be very glad to give directions. Of course I have fronds of most of the ferns I found.—P. Osterlund, Brooklyn, N. Y. *(in a letter to one of the editors)*.

On July 4th of this year I discovered near the base of Mt. Hor in the town of Westmore, Vt., a small group of plants of *Athyrium angustifolium*. This find brings the number of fern species in the Willoughby region to 36 and gives that locality a lead of one over Dorset, Vt. As far as the records are known to me this station is the farthest northeast so far reported for this fern.—E. J. Winslow, Auburndale, Mass.

THE WONDER FERN.—Last winter, in Toledo, Ohio, my hostess came from market one day bearing a paper package on which was printed "Aqua, The Wonder Fern." Inside was a printed slip: "It Grows in Water. Aqua, the Wonder Fern." Then a cut. Then "Easy to care for—Sure to grow. Guaranteed to live. It grows in water."

What do you think it was? Ten or a dozen stems of *Lycopodium lucidulum*, tightly tied together and cut off square, roots and all, so that it couldn't possibly grow in anything! Price, twenty-five cents.—M. A. MARSHALL, STILL RIVER, MASS.

A CORRECTION.—In assigning to the peculiar form of *Polypodium vulgare* described by Mr. Ridlon in a recent number of the Journal (Vol. 11, pp. 46-48) the name *rotundatum* the fact that Milde had long ago applied the same name to a European variety of *P. vulgare*—a quite different plant—was, unfortunately, overlooked. For this oversight, Mr. Ridlon was in no way responsible: he had not the necessary books at hand and left the searching of literature to me. A new name is required for the plant; it may, with reference to its much shortened pinnae, be called *Polypodium vulgare*, f. **brachypteron** Ridlon.—C. A. WEATHERBY.

American Fern Society

The following letter from Mr. D. L. Topping to Prof. Hopkins, used here by the latter's permission, should interest our members:

"It is a far cry from Siberia, but I think that my last contribution to the Society's herbarium was from Borneo, and now I am sending in this mail a small donation from Siberia. In the spring of 1919, as I

was thinking of a trip to the U. S., there came a call from the Red Cross in Siberia for help, and so I volunteered and spent about eight months there, being stationed in Vladivostok all the time. It was not all "battle, murder and sudden death" with us in Vladivostok, so what little spare time I could get I devoted to collecting. I must say it is not a fern lover's paradise: in fact the only fern I found in any abundance was an old time friend, *Osmunda cinnamomea*. I did occasionally run across a few plants of *Adiantum pedatum*, *Polypodium vulgare*, *Pteris aquilina*, *Camptosorus rhizophyllus*, etc., and I have about 30 specimens to add to the herbarium which I am leaving you to name up.

What the country about Vladivostok lacked in ferns it made up in flowering plants; in all my wanderings, excepting on some of the mountain meadows of Switzerland, I have never seen such a profusion of bloom: azaleas, buttercups, marsh marigolds, violets, iris, lilies, primroses, peonies, forget-me-nots, columbine, poppies, gentians, roses, orchids, syringas, spiraea, blue bells, clematis, fire weed and so on through the whole list, together with many things which were strange to me. On Russian Island, lying off in front of the harbor, there were lilies of the valley by the acre as fine and as fragrant as our garden variety; and one day at Fortress No. 6 I gathered an armful of cypripediums, one brilliant pink and the other a maroon and yellow. Late in the season the asters along the sea shore made a wonderful display with the very large flowers in all the shades of blue and pink.

Vladivostok has one of the most magnificent situations for a city that I have ever seen and if man would only "cease from troubling" I know of no place where a more delightful summer could be spent . . . .

Last month I finished my 19 years in the tropics and am planning to return to the U. S. this fall: just where I shall next dabble in fern collecting I cannot say. . . .

Mary Lowrey Anderson, daughter of John A. and Cornelia E. Coryell Anderson, was born January 13th, 1860, and died July 17th, 1921, at her home in Lambertville, N. J.

Her church and social duties, her philanthropic and civic work in her home town, occupied much of her time but in her leisure hours few things attracted her more than botanical pursuits.

Here, in the beautiful Delaware valley, her interest in plants began in early childhood, when it was the custom of the family to explore the woods in all directions, within driving distance, in search of flowers and ferns. In later years summers spent in New England, the North Woods, the Rocky Mountains and winters in the southern states, California, the Riviera and a spring and summer in Italy and Switzerland, where always the flora of the country was of absorbing interest, intensified her love of botany.

She assisted in the collection of fungi and mosses, a large number of which were photographed and colored by members of her family. The illustrations in "The Mushroom Book" and "The Moss Book" are a part of these collections.

Her interest in the special study of ferns began a few years ago when her attention was drawn to some fern gardens planted at Buck Hill Falls, Pa., and she began to collect and plant in her own garden, ferns to be found in her vicinity.

She had been a member of the Society since 1916.

Again the editors have to ask the members to be patient with the delays in issuing the JOURNAL. Everyone concerned is, we are sure, doing the best he can; but the troubles in the printing trade are not yet over and it takes a very long time to put the JOURNAL through the press. We are little, if any, worse off than many other scientific periodicals; and we hope for improvement soon.

With this number we return to our pre-war habit of publishing at least one illustration in each issue.

Either because of errors or of information received too late to be included, the following changes should be made in the recently issued list of members:-

Ackley, Mrs. H. C., not N. C.
Huss, J. F., 303 Sargeant St., Hartford, Conn.
Lenington, Mrs. Julia, R. D. 2, Pomona, Cal.
Lillibridge, Miss Amey A., 86 Wheeler Ave., Edgewood, R. I.

New members:

Punchard, Mrs. H., 14 Dana St., Brookline, Mass.

Word has been received of the deaths of Miss Agnes Wyman Lincoln and Mr. William Palmer.

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ERRATA

Page 49, footnote, line 2. For 4robably, read probably. Line 3. For p65, read 465.

Page 89, line 1. For *mexicana*, read *neomexicana*.

Page 89, line 18. For and varieties, read et varietates.

Page 95, line 9. For president, read present.

LIST OF MEMBERS

OF THE

American Fern Society

REVISED TO MAY 1, 1920

SUPPLEMENT TO

AMERICAN FERN JOURNAL

VOL. 10, NO. 2

List of Members of the American Fern Society

Supplement to American Fern Journal, Vol. 10, No. 2

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REVISED TO DECEMBER 1, 1921

SUPPLEMENT TO
AMERICAN FERN JOURNAL
VOL. 11, NO. 3

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Bailey, S. Waldo, 64 So. Mountain Road, Pittsfield, Mass 1921
Bancroft, Miss Jessie H., 164 Sterling Place, Brooklyn, N. Y. 1921
Barnes, Franklin Augustus, P. O. Box 44, Bellona, Yates Co., N. Y. . 1914
Barnhart, Dr. John Hendley, N. Y. Botanical Garden, New York 1911
Bartsch, Dr. Paul, Smithsonian Institution, Washington, D. C. 1911
Bass, Mrs. George, 85-71st St., Brooklyn, N. Y. 1920
Bates, Miss Ethel, Box 39, South Berwick, Maine 1917
Baxter, M. S., 46 Bly St., Rochester, N. Y 1912
Bean, Ralph C., 48 Emerson St., Wakefield, Mass. 1920
Bear, Mrs. Charles C., 654 Putnam Ave., Detroit, Mich. 1918
Beckwith, Miss Florence, 255 University Ave., Rochester, N. Y. 1918
Benedict, Dr. Ralph Curtiss, 322 East 19th St., Brooklyn, N. Y. 1905
Bigelow, Henry Clinton, 95 Winthrop St., New Britain, Conn. 1908
Bissell, Charles Humphrey, Southington, Conn 1897
Black, John G., R. D. No. 10, Wooster, O. 1921
Blake, Miss Louisa, 50 West St., Worcester, Mass. 1915
Bonaparte, Price Roland, 10 Avenue d'Iéna, Paris, France 1911
Boughton, Fred S., Pittsford, N. Y. 1917
Brainerd, Dr. Ezra, Middlebury, Vt. 1911
Braun, Miss Lucy E., 2702 May St., Cincinnati, Ohio 1920
Bray, Dr. William L., 1005 Harrison St., Syracuse, N. Y. 1916
Breckenridge, Prof. Lester Paige, Mason Laboratory, 400 Temple St., New Haven, Conn. 1915
Breckenridge, Mrs. Lester Paige, Mason Laboratory, 400 Temple St., New Haven, Conn. 1915
Briggs, S. Lynton, 188 Central Ave., Flushing, N. Y. 1920
Bristol, Miss B. Muriel, 33 Claredon Road, Egbaston, Birmingham, England 1910

Bristol, Cecil T., 33 Claredon Road., Egbaston, Birmingham.,England 1910
Britton, Mrs. Elizabeth Gertrude, 2965 Decatur Ave., New York 1911
Britton, Dr. Nathaniel Lord, N. Y. Botanical Garden, New York 1911
Brooks, Mrs. William F., 48 High St., New Britain, Conn. 1908
Brown, Alexander W., 9 Jefferson St., Auburn, N. Y. 1915
Brown, Miss Bertha M., 10 Greenman Ave., Westerly, R. I. 1921
Brown, Miss Elizabeth Gilman, 1004 West St., Utica, N. Y. 1904
Burgin, Herman, M. D., 63 West Chelten Ave., Germantown, Pa..... 1915
Burnham, Stewart Henry, Department of Botany, College of Agriculture, Ithaca, N. Y..... 1897
Burrage, Albert C., 85 Ames Building, Boston, Mass. 1921
Bush, Benjamin Franklin, Courtney, Mo. 1909
Butler, Mrs. Ellis Parker, 242 State St., Flushing, N. Y. 1918
Butters, Prof. Frederic K., University of Minnesota,Minneapolis, Minn. 1917

Campbell, Dr. Douglas Houghton, Stanford University, Cal..... 1915
†Capp, Seth Bunker, P. O. Box 2054, Philadelphia, Pa. 1915
Carhart, Macy, Keyport, N. J..... 1915
Chamberlain, Edward B., 18 West 89th St., New York..... 1920
Cheever, Dr. Austin Walter, 12 Avondale Road, Newton Center, Mass 1911
Child, Mrs. H. W., Hotel Bristol, Boston, Mass. 1915
Child, W. A., 389 Hess St., South, Hamilton, Ontario 1917
Choate, Miss Alice D., 3739 Windsor Place, St. Louis, Mo. 1898
‡Christensen, Carl, Mag. Sci., Botanical Museum, Copenhagen, Denmark 1915
Clarke, Miss Elizabeth F., 54 Forrester St., Newburyport, Mass. 1921
Clarkson, E. H., 41 Tyng St., Newburyport, Mass. 1917
Cleveland, Mrs. Frederick A., 70 Winter St., Norwood, Mass..... 1920
*Clute, Prof. Willard Nelson, Joliet, Ill. 1893
Cole, Miss Lillian A., Union, Maine 1916
Colman, Miss Harriet, 14 Harris St., Newburyport, Mass. 1921
Comstock. John Belden, New Britain, Conn. 1918
Connolly, Mrs. T. F., Elm Way off High St., Westboro, Mass. 1921
Corne, Miss F. E., Suite 407 Craigie Hall, University Road, Cambridge, Mass. 1912
Cornman, Mrs. L. R., Camp Kearney, San Diego, Cal. 1917
Cowan, Alexander, Valleyfield, Penicuik, Midlothian, Scotland 1914

Dacy, Miss Alice Evelyn, 98 Hemenway St., Boston, Mass..... 1898
Darling, Miss Nancy, "Sky Farm," R. D. No. 2, Woodstock, Vt. 1909
Davenport, Mrs. Elizabeth Braxton, 45 Green St., Brattleboro, Vt.... 1901
Davis, A. E., 1327 Grove St., Berkeley, Cal. 1921
Davis, Rev. John, 318 North 7th St., Hannibal, Mo..... 1909
Deam, Charles Clemon, 103 Main St., Bluffton, Ind..... 1905
Deane, Walter, 29 Brewster St., Cambridge, Mass. 1911
Demetrio, Rev. C. H., Emma, Saline Co., Mo. 1900
Detmers, Miss Freda, Ohio Experiment Station, Wooster, Ohio 1920
Dowell, Dr. Philip, Port Richmond, N. Y..... 1906
Dunton, Miss Nellie Frances, 14 Green St., Bath, Maine 1914
Durand, Dr. Elias J., University of Minnesota, Minneapolis, Minn. .. 1911

Eames, Mrs. Edward A., 155 Bryant St., Buffalo, N. Y..... 1918
Eaton, Frederick W., Concord, Mass. 1921
Eggleston, Willard Webster, U.S. Dept. of Agriculture,Washington, D.C. 1911
Emmons, Edwin Thayles, Geneva, N. Y. 1915
Evans, J., R. D. No. 6, Box 336, Seattle, Wash..... 1916

Farwell, Oliver Atkins, 271 South Ave., Detroit, Mich..... 1913
Fellows, Dr. Dana W., 7671 Amboy Road, Tottenville, Richmond Borough, New York 1900

Ferguson, William C., 60 Front St., Hempstead, N. Y. 1920
Ferriss, James H., Joliet, Ill. 1901
Fitzpatrick, Prof. T. J., Bethany, Neb. 1911
Flett, J. B., Ashford, Longmire Springs, Wash. 1899
Floyd, Fred Gillan, 69 Perham St., West Roxbury, Mass. 1897
Flynn, Mrs. Nellie F., 251 South Willard St., Burlington, Vt. 1910
Forbes, Fayette Frederick, Brookline, Mass. 1911

Gardner, Mrs. Edwin P., 140 Gibson St., Canandaigua, N. Y. 1919
Gaudette, Miss Marie E., Park Museum, Providence, R. I. 1921
Goddard, Miss Mina Keyes, 11 Bedford St., Lexington, Mass. 1897
Goodale, Prof. Alfred S., Dept. of Botany, Amherst College, Amherst, Mass. 1921
Goodwin, Rev. Francis, 103 Woodland St., Hartford, Conn. 1916
Graves, Edward W., Stockport, Iowa 1917
†Greene, F. C., 30 North Yorktown St., Tulsa, Okla. 1913
Grigg, Frederic W., P. O. Box 43, Newtonville, Mass. 1915
Grout, Dr. Abel Joel, New Dorp. Richmond Borough, New York 1910
Grubb, Prof. Percy Lamar, 417 Briggs St., Harrisburg, Pa. 1905
Gruber, C. L., Kutztown, Pa. 1907

Hagerman, Samuel J., 1024 39th Ave., Oakland, Cal. 1921
Hale, Miss Marcia E., Elizabethtown, N. Y. 1920
Hall, Mrs. Carlotta C., 1615 LaLoma Ave., Berkeley, Cal. 1913
Halsey, Harold V. M., 957 Boulevard, Astoria, Long Island, N. Y. 1921
Harper, Dr. Robert Almer, Columbia University, New York 1913
Harris, Sidney, R. D. No. 1, Vineyard Haven, Mass. 1921
Hartline, Mrs. D. S., State Normal School, Bloomsburg, Pa. 1910
Hazen, Dr. Tracy Elliot, Columbia University, New York 1910
Heatley, Miss Margaret, University of South Africa, Box 1176, Johannesburg, South Africa 1916
Higgins, D. F., Claremont, Ill. 1913
Holtzoff, Mrs. Mary, 145 West 123d St., New York 1917
Hopkins, Prof. Lewis S., 525 East Main St., Kent, Ohio 1905
Horr, Mrs. Ella L., 12 State St., Worcester, Mass. 1911
House, Dr. Homer D., Education, Building, Albany, N. Y. 1918
Howe, Dr. Marshall Avery, N. Y. Botanical Garden, New York 1911
Humphrey, Geo. Scranton, Clayville, Oneida Co., N. Y. 1911
Humphrey, Miss Lillian, 311 South 8th Ave., Ironton, Ohio 1920
Hunnewell, Francis Welles, 5 University Hall, Cambridge, Mass. 1915
Huntington, J. Warren, Haverhill Road, Amesbury, Mass. 1921
Huss, John Francis, 1103 Asylum Ave., Hartford, Conn. 1903

Irvine, Mrs. Alice L., 1264 Garfield Ave., Pasadena, Cal. 1920

James, Mrs. Walter B., 7 East 70th St., New York 1921
Jackson, Joseph, 25 Woodland St., Worcester, Mass. 1898
Jellett, Edwin C., 118 Hermann St., Germantown, Pa. 1913
Jenks, Charles William, Stonecroft Farm, Bedford, Mass. 1908
Jenney, Hon. Charles Francis, Court House, Boston, Mass. 1901
Jennings, Dr. Otto Emery, Carnegie Museum, Pittsburgh, Pa. 1911
Jurica, Hilary S., St. Procopius College, Lisle, Ill. 1919

Kaufman, Miss Pauline, 173 East 124th St., New York 1900
Keeler, Mrs. L. M., P. O. Box 473, Scarsdale, N. Y. 1913
Kelsey, Harlan P., Salem, Mass. 1921
Kendall, Miss Alice C., Holden, Mass. 1911
Kidder, Nathaniel T., 53 State St., Room 1001, Boston, Mass. 1921

Killip, Ellsworth P., U. S. National Museum, Washington, D. C..... 1916
Kimball, Miss Laura F., National City, San Diego Co., Cal. 1897
Kirkham, Prof. William B., 100 Mill St., Springfield, Mass..... 1921
Knowlton, Clarence Hinckley, Hingham, Mass. 1911
Knowlton, Dr. Frank Hall, U. S. National Museum, Washington, D. C. 1912
Kobbé, Frederick W., 103 East 86th St., New York 1921

Lamprey, Mrs. E. S., 2 Guild St., Concord, N. H..... 1897
Lee, Mrs. Charles W., Jr., 80 South Burritt St., New Britain, Conn. 1914
Leeds, Arthur N., 5321 Baynton St., Germantown, Pa. 1921
Leland, George H., 2 Hunter St., Providence, R. I. 1921
Lenington, Mrs. Julia, Wyoming, N. Y. 1920
Leonard, Emery C., National Museum, Washington, D. C. 1920
Lewis, Rev. Charles Smith, 835 Edgewood Ave., Trenton, N. J. 1917
Lewis, William Fisher, 2d, 835 Edgewood Ave., Trenton, N. J..... 1920
Lewis, W. Scott, 2500 Beachwood Drive, Holywood, Los Angeles, Cal. 1909
Lillibridge, Miss Amey A., 86 Wheeler Ave., Edgemond, Long Island, N. Y. 1921
Lincoln, Miss Agnes Wyman, Lincoln Road, Medford, Mass. 1902
Litch, C. M., 14 Burnap St., Fitchburg, Mass. 1916
Logue, Dr. Everett G., 1601 Almon St., Williamsport, Pa. 1920
Lombard, Mrs. Charles P., 92 Court St., Plymouth, Mass. 1910
Lombard, Dr. Robert H., Geophysical Laboratory, 2801 Upton St., N. W., Washington, D. C..... 1916
Long, Bayard, Ashbourne, Montgomery Co., Pa. 1911
Lorenz, Miss Annie, 96 Garden St., Hartford, Conn..... 1919
Lowe, Mrs. Frank E., 24 Brattle St., Worcester, Mass..... 1917
Lyon, Dr. Harold Lloyd, P. O. Box 411, Honolulu, H. I. 1911

McAvoy, Miss Blanche, Box 109, Foley Road, Price Hill Sta., Cincinnati, Ohio 1920
McColl, W. R., 908 2d Ave., East, Owen Sound, Ontario 1917
McEwen, Alfred, Tarrytown, N. Y. 1921
McFarland, Prof. Frank T., University of Kentucky, Lexington, Ky. . 1915
Macy, Perry D., Smyrna, N. Y..... 1919
Mansfield, Mrs. Bessie R., Westboro, Mass. 1921
Mark, Miss Clara G., 270 South State St., Westerville, Ohio 1913
Marshall, Miss M. A., Still River, Mass. 1906
Marshall, Dr. Ruth, Rockford College, Rockford, Ill. 1914
Martin, Everett P., 85 Wilson Ave., Flushing, N. Y..... 1917
Maxon, William Ralph, U. S. National Museum, Washington, D. C... 1895
Mendelson, Dr. Walter, 639 Church Lane, Germantown, Pa. 1910
Merrill, Mrs. Ethelwyn Foss, Norwood Narrows, N. H. 1914
Merrill, G. K., 564 Main St., Rockland, Maine..... 1913
Merrill, Henry Wilson, Hiram, Maine..... 1906
Miller, Robert K., Keyser Building, Baltimore, Md. 1917
Minor, John Bacon, New Britain, Conn. 1917
Mirick, Miss Nellie, 28 East Walnut St., Oneida, N. Y. 1896
Mitchell, Mrs. Mina B., M. D., Box 48 Station A, Chattanooga, Tenn. 1914
Moore, Dr. George T., Missouri Botanical Garden, St. Louis, Mo. ... 1915
Mottier, Dr. David Myers, Indiana University, Bloomington, Ind. ... 1911
Mousley, H., Hatley, Quebec 1920
Moxley, Rev. George L., 1964 East First St., Los Angeles, Cal. 1909
Mulford, Miss Harriet, 127 Fulton Ave., Hempstead, N. Y. 1910
Mulliken, Robert S., 5520 Blackstone Ave., Chicago, Ill. 1921
Mumbauer, Joseph R., 601 Main St., Pennsburg, Pa. 1921
Munger, Dr. Edwin Holmes, 902 Main St., Hartford, Conn. 1914
Munz, Philip A., Dept. Botany, Pomona College, Claremont, Cal. ... 1921

Nelson, James C., 531 North Cottage St., Salem, Ore. 1918
Newell, Chauncey Jackson, Alstead, N. H. 1902
Noble, Mrs. Mary Adam, Inverness, Fla..... 1896
Noyes, Miss Elmira Elsie, 117 Dinwiddie St., Portsmouth, Va. 1893

Oleson, Olaf Martin, Fort Dodge, Iowa 1900
Oliver, Miss Mary H., 270 South State St., Westerville, Ohio 1920
Orr, Ellison, Waukon, Iowa 1909
Osmun, Prof. Albert Vincent, Agricultural College, Amherst, Mass. .. 1901
Osterlund, P., 153 Brinkmeyer Ave., So. Ozone Park, N. Y. 1920
Otis, Ira C., 4320 First Ave., N. E., Seattle, Wash. 1921
Overacker, Miss Minnie L., 109 Robineau Road, Syracuse, N. Y. 1915

Palmer, Ernest Jesse, 321 South Allen St., Webb City, Mo..... 1909
Palmer, T. Chalkley, Media, Pa. 1898
Palmer, Dr. Theo. Sherman, 1939 Biltmore St., N. W., Washington, D. C. 1911
Palmer, William, Smithsonian Institution, Washington, D. C..... 1899
Patterson, Miss Roberta M., 422 Randolph St., N. W., Washington, D. C. 1920
Peckman, Mrs. Wheeler H., Davenport Neck, New Rochelle, N. Y. .. 1917
Pember, Frank T., Granville, N. Y. 1908
Penrose, Mrs. Clement B., 182 West Chelten Ave., Germantown, Pa. 1900
*Petty, Prof. W. J., Ocean City, N. Y..... 1893
Phair, Miss Gertrude G., 804 East 19th St., Brooklyn, N. Y. 1916
Pickett, Prof. Fermen Layton, Pullman, Wash. 1914
Plitt, Prof. Charles C., 3933 Lowndes Ave., Baltimore, Md. 1898
Pond, Bremer Whidden, 18 Tremont St., Boston, Mass. 1910
Poyser, W. A., 207 South 37th St., Philadelphia, Pa..... 1918
Pratt, Mrs. Charles, 4806 South Salina St., Syracuse, N. Y..... 1915
Pretz, Harold W., 368 Union St., Allentown, Pa. 1909
Prince, Prof. S. Fred, Agricultural College, Manhattan, Kan. 1905
Provo, W. F., Wickliffe, Ohio 1921
Pugsley, Frank W., Pittsford, N. Y. 1920
Purdy, Carl, Ukiah, Cal. 1921
Purdy, F. A., Hardwick, Vt. 1921
Putnam, Mrs. W. S., New Salem, Mass. 1918

Radlo, Miss Dora A., 32 Cherry St., North Adams, Mass. 1894
Rand, Edward Lathrop, 53 State St., Boston, Mass. 1914
Ransier, Herbert Earl, Manlius, N. Y. 1902
Redles, George, 207 East Wister St., Germantown, Pa..... 1913
Rhodes, Charles Orman, Lock Box 366, Groton. N. Y..... 1896
Richards, Mrs. Viola F., Box 110, South Deerfield, Mass. 1921
Ridlon, Harry Cooper, Green Mountain School, Bennington, Vt. 1908
Roberts, Miss Louise Wright, 520 Roberts Ave., Syracuse, N. Y. 1915
Robertson, Carl T., 1626 Hollyrood Road, N. E., Cleveland, O. 1921
Robinson, Dr Winifred J., Women's College of Delaware, Newark, Del. 1911
Rooney, Mrs. Anna K., 368 Lafayette Ave., Brooklyn, N. Y. 1916
Rose, Milton Sawyer, 187 Fayerweather St., Cambridge, Mass. 1918
†Rossberg, William B., 44 Hawkins St., New Britain, Conn. 1911
Rugg, Harold Goddard, Dartmouth College, Hanover, N. H. 1906

Safford, William Edwin, 3339 Mt. Pleasant St., Washington, D. C..... 1901
Sage, John Hall, Portland, Conn..... 1916
Sanford, Samuel Newton Folius, P. O. Box 702, Fall River, Mass..... 1918
Schaffner, Prof. John H., Ohio State University, Columbus, Ohio..... 1920
Schulz, Miss Ellen L., 1025 Summit Ave., San Antonio, Tex. 1921

Scott, James Grimshaw, 123 West Price St., Germantown, Pa. 1913
Scott, Mrs. Willard, 10 Park St., Brookline, Mass. 1917
Scoullar, Mrs. Albert E., Sebago Lake, Maine 1904
Shaw, Prof. Ethan Allen, Northfield, Vt. 1916
Shreve, Dr. Forrest, Desert Botanical Laboratory, Tucson, Ariz. 1912
Sloper, Harold T., 36 Russell St., New Britain, Conn. 1916
Smith, Mrs. Frank C., 47 West St., Worcester, Mass. 1920
Spalding, Miss Rebecca Wentworth, 2 St. Nicholas Place, New York . 1912
Standley, Paul Carpenter, Smithsonian Institution, Washington, D. C. 1915
Stebbins, Miss Ida Huntley, 52 Albemarle St., Rochester, N. Y. 1915
Steil, Dr. William N., 115 South Warren St., Madison, Wis. 1916
Stokes, Francis J., 629 Church Lane, Germantown, Pa. 1921
Stowell, Willard A., 41 Delawareview Ave., Trenton, N. J. 1900
Stratton, Mrs. G. W., 439 Rebecca Ave., Wilkinsburg, Pa. 1916
Stupp, Fred J., 1 Sherman St., Auburn, N. Y. 1915
Suksdorf, Wilhelm Nikolaus, Bingen, Wash. 1914
Suydam, Miss Anna B., 47 Caroline St., Rochester, N. Y. 1917
Swain, Rev. James Ramsey, 428 South 44th St., Philadelphia, Pa. 1919
Swinerton, John R., 2115 Chestnut Ave., Newport News, Va. 1909

Tilley, Trenor P., 1356 Northampton St., Holyoke, Mass. 1921
Todd, Dr. J. B., 740 South Beech St., Syracuse, N. Y. 1915
Topping, D. LeRoy, Jefferson, Schoharie Co., N.Y. 1896
Trudell, Harry W., 2030 East Madison St., Philadelphia, Pa. 1919
True, Eben, Amesbury, Mass. 1921

Underwood, Jay Gove, Hartland, Vt. 1910

Victorin, Rev. Bro. Marie, Longueuil College, Quebec 1917

Ware, Robert Allison, 246 Devonshire St., Boston, Mass. 1903
*Waters, Dr. Campbell E., Bureau of Standards, Washington, D. C. .. 1893
Weatherby, Charles Alfred, 11 Wells Ave., East Hartford, Conn. 1912
Weatherby, Mrs. Charles Alfred, 11 Wells Ave., East Hartford, Conn. 1914
Wharton, Miss Susan P., 910 Clinton St., Philadelphia, Pa. 1911
Wheeler, Dr. Edward J., 79 Chapel St., Albany, N. Y. 1907
Wheeler, Miss Harriet, Chatham, N. Y. 1895
†Wheeler, Leston Ansel, Townshend, Vt. 1914
Wherry, Dr. Edgar T., Bureau of Chemistry, Department of Agriculture, Washington, D. C. 1918
White, David, U. S. National Museum, Washington, D. C. 1901
White, Kelton, E., 4354 Maryland Ave., St. Louis, Mo. 1919
Wilcox, Prof. Alice Wilson, Brennan College, Gainesville, Ga. 1915
Wilcox, Miss Fannie E., 3 Narragansett Ave., Westerly, R. I. 1921
Williams, Miss Carrie Hammond, 1428 Park Ave., Baltimore, Md. 1904
Williams, Mrs. Franklin, D., 24 Dean St., Taunton, Mass. 1921
Wilsie, Elmer, Jr., Tomkins Cove, Rockland Co., N. Y. 1920
†Winslow, Evelyn James, 222 Grove St., Auburndale, Mass. 1902
Winslow, Dr. G. M., Lasell Seminary, Auburndale, Mass. 1909
Winslow, Miss Inez J., Orleans, Vt. 1911
Woodward, Richard William, 22 College St., New Haven, Conn. 1915
Worthen, Mrs. Effie Adams, 5 Clarks Road, Amesbury, Mass. 1921

Young, Mrs. Charles E., Florence Court, West 204, Washington, D. C. 1907
Young, John P., 801 Market St., Williamsport, Pa. 1920
Youngs, Mrs. Jennie B., 309 South Seward Ave., Auburn, N. Y. 1921

Ziegler, S. W., R. D. No. 4, Dover, Pa. 1918

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